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Endoscopic ampullectomy

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Ampullary tumors are rare tumors of the gastrointestinal tract. Compared with surgery, the endoscopic approach to remove these tumors by ampullectomy is associated with lower morbidity and mortality. Recent developments in endoscopic ultrasound, including intraductal ultrasound, have enabled accurate T staging of these tumors, and allowed the selection of appropriate candidates for endoscopic therapy. Currently, there is no standardization for the technique of endoscopic ampullectomy. In expert hands, endoscopic ampullectomy for benign adenomas leads to successful tumor eradication in more than 85% of patients. Regular endoscopic surveillance of the resected site is essential in all patients after ampullectomy, as tumor recurrence occurs in up to 20% of patients. This article reviews and discusses the indications for, and techniques and outcomes of, endoscopic ampullectomy.

Tumors of the ampulla of Vater are rare and are most commonly benign adenomas.[1] These tumors can occur sporadically or in the context of genetic syndromes, such as familial adenomatous polyposis (FAP) and hereditary nonpolyposis colorectal cancer, and carry the potential of malignant transformation to ampullary carcinomas.[1,2] This risk is highest in patients with FAP, who are 100 times more at risk of developing ampullary cancer than the general population.[3]

Historically, ampullary tumors have been treated surgically either by transduodenal local resection (LR) or pancreaticoduodenectomy (PD).[4] PD has the benefit of a low recurrence rate, but carries high morbidity (50%-63%) and mortality rates (5%-9%).[5-7] Conversely, the lower morbidity (14%-27%)[8,9] and mortality (0%-4%)[7,9] rates of LR are associated with higher recurrence rates (17%-32%).[8,10] Mean length of hospital stay ranges from 11 to 13 days following LR and 15-23 days following PD.[8,9]

Since its first description in 1983 by Suzuki et al[11] and the first large case series in 1993 by Binmoeller et al,[12] endoscopic ampullectomy has gained widespread acceptance for the treatment of benign adenomas. Eradication can be achieved in >85% of cases[13-16] with low morbidity and mortality. Furthermore, hospitalization can be avoided in most patients, since endoscopic ampullectomy can usually be performed with conscious or deep sedation on an outpatient basis. This article will review the current literature on the evaluation, indications, techniques, and outcomes of endoscopic ampullectomy.

Pre-ampullectomy evaluation

All ampullary lesions should be carefully examined with a duodenoscope, and multiple biopsies should be taken as it is difficult to distinguish an ampullary adenoma from hamartoma, carcinoid tumor, gangliocytic paraganglioma, and adenocarcinoma based on the endoscopic appearance alone. A minimum of 6 biopsies have been recommended to increase histologic yield.[13] The sensitivity of endoscopic biopsies for detection of malignancy is only approximately 50%, as foci of carcinomatous tissue within the ampullary adenoma can be missed.[9,17,18] Studies have indicated that the frequency of malignant foci in an adenoma of the ampulla is approximately 26% to 30%.[8,19] Thus, a negative biopsy does not rule out the presence of cancer, and careful examination of the ampullectomy specimen is vital.

Staging

As with other tumors, accurate staging is crucial in planning the treatment of ampullary tumors. Computed to-

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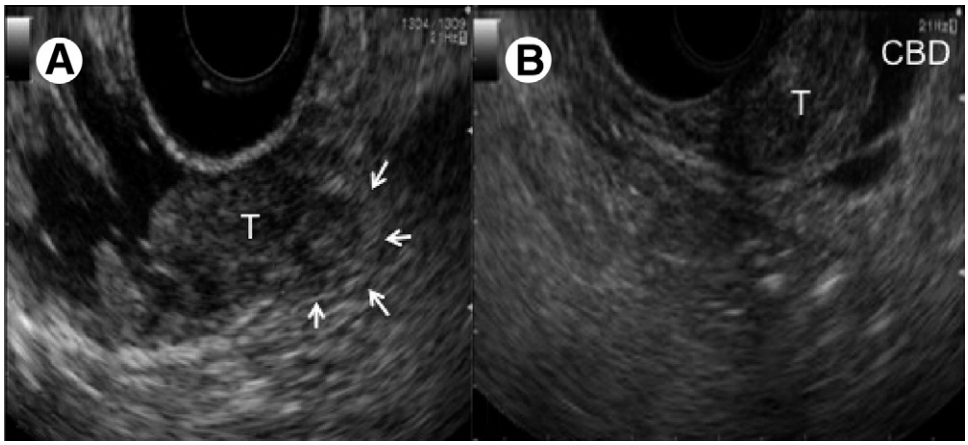

Figure 1 Evaluation of local extension of ampullary tumors (T) by endoscopic ultrasound, demonstrating (A) the presence of tumor invasion into the duodenal wall (arrows) of a T2-stage ampullary cancer, and (B) the presence of tumor extension into the distal common bile duct (CBD).

mography (CT) scan, magnetic resonance imaging (MRI), and positron emission tomographic scans are highly sensitive for the detection of distant metastases.[20] In the assessment of nodal involvement, MRI has been found to be superior to both CT and endoscopic ultrasound (EUS).[20] EUS is the imaging modality of choice for local T staging, as it is able to accurately determine the depth of tumor invasion relative to the duodenal wall layers and detect involvement of the bile and pancreatic ducts (Figure 1). A study by Cannon et al showed that EUS was superior to CT or MRI for T staging of ampullary tumors (78% for EUS vs 24% and 46% for CT and MRI, respectively), although its accuracy can be reduced by the presence of a transpapillary stent or prior sphincterotomy. Intraductal ultrasound has been observed to be even more accurate than conventional EUS for T staging (87% vs 63%),[21] especially in the assessment of tumor extension to the bile or pancreatic duct. However, advances in electronic imaging using conventional EUS may be closing this gap; our group has shown that the accuracy of T staging for ampullary tumors using the electronic echoendoscope was as high as 86%.[22] We recommended that EUS be performed before endoscopic or surgical resection, given its high accuracy in T staging. It has been proposed that EUS can be waived for lesions $\leq$1 cm in diameter without suspicious signs of malignancy (ulceration, induration, bleeding), but this needs further prospective study and validation.[23]

Tumor extension into either ductal system can also be assessed by endoscopic retrograde cholangiopancreatography (ERCP). This should be performed before ampullectomy if EUS is not available or the findings on EUS are equivocal. Although the presence of intraductal extension of tumor generally indicates the need for surgery,[24] it has been shown that tumor extension of $<$1 cm into the common bile duct or pancreatic duct can be further resected and ablated endoscopically.[16,25]

Indications and contraindications

Currently, there is no consensus on the management of ampullary tumors. Factors that impact treatment strategy include the patient's general health, tumor characteristics, and available expertise. Ampullary adenomas, especially those with high-grade dysplasia, warrant therapy because they are "time bombs" for malignancy and may already harbor malignancy missed on biopsy.[9,17] Although endoscopic resection is widely embraced as first-line therapy in patients with benign ampullary tumors,[7,13,26] the final treatment decision is based on the histologic findings of the resected specimen. The presence of invasive carcinoma in the specimen indicates the need for definitive surgical resection. Lesions with endoscopic features of induration, ulceration, excessive friability, or a "non-lifting sign" (failure to raise with submucosal injection) are likely to be malignant and surgical resection is indicated,[26] even in the absence of malignancy on biopsy specimens. In patients who are poor candidates for surgery or who refuse surgery, endoscopic resection with ablative therapy can be considered despite unfavorable tumor characteristics. In case reports, endoscopic ampullectomy has been reported to successfully eradicate early T1 ampullary adenocarcinoma,[27] as well as lesions (adenomas?) with intraductal growth.[16]

Although there are no published guidelines as to the size or diameter above which endoscopic removal of ampullary adenomas should not be attempted, most agree that the resection of lesions of size greater than 4-5 cm carries excessive risk for complications and incomplete resection. The size of the lesion affects the endoscopic approach to resection as larger lesions require piece-meal resection. Ampullary adenomas up to 7 cm in size have been resected.[28]

Techniques of endoscopic ampullectomy

Endoscopic ampullectomy is performed with a standard duodenoscope in a similar manner to snare polypectomy of