

Enucleation for benign or low-grade malignant lesions of the pancreas: Single-center experience with 65 consecutive patients

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Introduction. Standard resection for benign and borderline neoplasms of the pancreas is associated with a substantial risk of postoperative morbidity and long-term functional impairment, whereas enucleation leads to less morbidity and preserves healthy parenchyma as well as pancreatic function. The aim of this study was to evaluate the postoperative clinical outcomes and long-term functional and oncologic results after pancreatic enucleation, and to compare the clinical results of laparoscopic and open enucleation.

Methods. From March 2005 to December 2013, 65 cases of enucleation of benign tumors in the pancreas were identified through a retrospective review of medical records.

Results. Most of the patients were women (73.8%), and the median age was 52.7 years (interquartile range 43.1–60.9 years). Median tumor size was 2.5 cm (interquartile range 1.6–3.8 cm). The most common indication for enucleation was pancreatic neuroendocrine tumor (24, 36.9%). A clinically relevant pancreatic fistula (International Study Group on Pancreatic Fistula grade B, C) was reported in 6 patients (9.2%). The patients with tumors of the pancreatic neck had more complications after enucleation than those with tumors at other locations (3/4, 75%). There were no differences of clinical outcomes between open and laparoscopic enucleation groups. At a median follow-up of 58.7 months there was one case of new-onset diabetes, and there were no recurrences or deaths.

Conclusion. Enucleation is a safe and effective procedure for the treatment of benign and borderline pancreatic neoplasms. It preserves pancreatic function and is not associated with recurrence. The incidence of postoperative complications, including pancreatic fistula, is acceptable. Laparoscopic enucleation seems to be a feasible and safe approach associated with favorable perioperative outcomes for the selected patients. (*Surgery* 2015;158:1203-10.)

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ENUCLEATION CAN PRESERVE NORMAL PANCREATIC PARENCHYMA and reduce the risk of endocrine and exocrine insufficiency and thus has been proposed as an alternative operative procedure for some benign and low-grade malignant tumors of the pancreas.^{1,2} Recently, there have been several reports about the short- and long-term results of pancreatic

enucleation³⁻⁵; however, the majority of the studies involved small numbers of cases. Therefore, the short-term surgical and long-term functional outcomes and oncologic results of enucleation are not well-defined. In addition, although there have been some studies of the feasibility of laparoscopic enucleation (L-enucleation),⁶⁻⁸ its efficacy relative to open enucleation (O-enucleation) has not been established. The aim of this study was to evaluate postoperative clinical outcomes and the long-term functional and oncologic results of pancreatic enucleation, and to compare the clinical results of L- and O-enucleation.

METHODS

Sixty-five patients with benign or low-grade malignant tumors of the pancreas who underwent

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pancreatic enucleation from March 2005 to December 2013 at the Asan Medical Center in Korea were included in this study. Demographic information, clinical manifestations, preoperative evaluations, intraoperative details, postoperative complications, and pathologic data were collected.

The preoperative radiological assessment consisted of a contrast-enhanced computed tomography (CT), an endoscopic ultrasonography (EUS), and magnetic resonance cholangiopancreatic imaging (MRCP). The CT scan is performed routinely as standard diagnostics for localization of the tumor. If the CT scan is insufficient to diagnose, the patient is referred for EUS or MRCP. EUS allows the physician to get in very close proximity to the pancreas, which results in very detailed imaging of the organ. If the lesions were very small and we could not determine the malignancy of the tumor by CT scan, we usually used EUS.

The physician could often times visualize details of the pancreas that could not be seen with CT. The biggest advantage of EUS is that, unlike with CT, pancreatic biopsies and cytology can be safely and easily obtained at the time of the exam. We have used EUS for preoperative biopsy of the tumor and the cystic fluid cytology.

MRCP can provide high-quality pictures of the pancreas, especially the pancreatic duct, and the bile ducts. It is essential to evaluate the relationship between tumors and pancreatic or bile duct. We have used MRCP for performing precise measurement of the distance between the tumor and the bilopancreatic duct. We usually used the MRCP for evaluating cystic lesion of pancreas. MRCP accurately depicted the cystic morphology and could demonstrate the relationship of the cyst to the pancreatic duct. In addition, intraoperative ultrasonography (IOUS) was performed in doubtful cases to identify the lesions, to determine their proximity to the main pancreatic duct, and to rule out the presence of multifocal lesions. Intraoperative frozen-section examination was performed routinely to provide information that was used to identify the lesions. After comprehensive preoperative assessment, none of the patients had evidence of local invasion or metastasis; all the pancreatic lesions were considered to be without pancreatic ductal invasion and to be suitable for enucleation.

Follow-up data were obtained from patient records, supplemented by telephone contact. The median follow-up was 58.7 months (interquartile range [IQR] 20.6–80.3 months), and all patients were followed up.

Complications were classified according to the Clavien-Dindo classification. Those of grade III or greater were regarded as major complications. Pancreatic fistulae (PF) were defined and graded according to the International Study Group on Pancreatic Fistula. Grades B and C PF were defined as clinically relevant PF.

We left a closed-suction drain near the resection site and checked the amylase and lipase of the drainage fluid every day in all cases. After the patient began a soft diet, we performed a postoperative abdominal pelvic CT. If there were no evidence of clinically relevant pancreatic fistula according to International Study Group on Pancreatic Fistula and no sign of fluid collection on CT, we removed the drain.

Postoperative mortality rates included all in-hospital deaths or deaths which occurred within 30 days of surgery. The immediate causes of morbidity and duration of hospitalization were recorded.

New-onset diabetes was defined as diabetes with a requirement for medical treatment, including hypoglycemic medication and insulin. New-onset exocrine insufficiency was defined as steatorrhea and severe weight loss (more than 10% of initial body weight) requiring pancreatic enzyme supplementation. Tumor recurrence was evaluated by routine CT check-up.

Operative procedure. L- and O-enucleation was decided by the patient's and operator's preference. Patients were informed of the possible complications of the procedures and the advantages and disadvantages of a laparoscopic compared with an open approach and then they decided on the approach method. Deep or posterior lesions, which are located in the right side of the superior mesenteric vein, usually are indicated for open approach in our center. In this study, L- and O-enucleation were performed by 6 experts of hepatobiliary pancreatic surgery. Three of the 6 hepatobiliary surgeons have performed both operative approaches. The rest have only performed open approach. Although the surgeons' preference of approaching methods was different, the experience of the surgeons in each group was similar.

Laparoscopic enucleation. Patients were placed in a supine or semi (30°) right lateral decubitus position in the reverse Trendelenberg position. The operator and the second assistant who held the laparoscope stood to the right of the patient, whereas the first assistant and scrub nurse were positioned to the left. The laparoscopic approach requires 4 or 5 trocars. First, the body and tail of the pancreas were exposed through a large window

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