Pancreaticoduodenectomy

Waled Mohamed Abd El-Rahman[1*], Prof. Abu Bakr M. Mohie Eldin[2], Prof. Dr. Moatasem Mohammad Ali[3], Prof. Samy Ramzy Shehata[4], Dr. Haitham Fekry Othman[5]

Abstract

Pancreaticoduodenectomy (PD) is the only potentially curative therapy for malignancies of the pancreatic head and periampullary region. Despite this complicated surgical operation is mature, the low R0 resection rate remains the major obstacle to improving the prognosis of pancreatic cancer.

Key Words:PD, Surgery, Pancreatic Cancer.

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Introduction

Radical PD (R0 resection) is the only option offering hope of a long-term survival to patients presenting with pancreatic head cancer or malignant periampullary tumors. However, the negative resection margin (R0 resection) is a vital prognostic factor related to long-term survival [1,2], More than 80% of patients with pancreatic cancer cannot completely have their pancreatic mesenterium resected [3]. In addition, curative surgical resection of the pancreatic mesenterium surrounding the superior mesenteric artery (SMA) and surgical field exposure were the most challenging procedures to achieve R0 resection in PD [5].

Operative blood loss was also an unavoidable risk factor in the Whipple's procedure, particularly at the stage of separation between the pancreatic head and the SMA. At this stage, the pancreatic head is saturated with blood, and the risk of excessive blood loss may increase, which caused a dim surgical field and hampered hemostasis. Hence, the difficulty of R0 resection in the Whipple procedure increases [5].

The mortality following PD has been a remarkable decline with the advances of surgical techniques. [6] However, 80% of patients with pancreatic cancer had concomitant distant metastases at the time of diagnosis and only 10% were clearly resectable, and 10% were potentially inoperable because of the advanced stage. [7] This has driven surgeons to improve resection rates. A consensus on the definition and treatment of borderline resectable pancreatic head cancer (BRPHC) was published by the International Study Group of Pancreatic Surgery (ISGPS).[8] During the last decade, vascular resection techniques used in borderline resectable pancreatic cancer have remarkably improved resection rates.[9,10] The ISGPS supports the imaging-based National Comprehensive Cancer Network (NCCN) criteria for borderline resectability in cases of venous mesentericoportal-axis involvement and arterial involvement.[11] We propose to categorize pancreatic head cancer into four distinct types based on vascular involvement. Type I is pancreatic head cancer without vascular invasion; based on NCCN criteria, it is considered a localized and clearly resectable pancreatic head cancer. Types II, III, and IV pancreatic head cancer are BRPHC as defined by the ISGPS. [12] Type II patients have BRPHC with venous-only mesentericoportal-axis involvement; type III, BRPHC with arterial-only involvement; and type IV, BRPHC with both venous and arterial involvement. In pancreatic head cancer, venous mesentericoportal-axis involvement is most common in BRPHC.

Corresponding author: Waled Mohamed Abd El-Rahman
Address: [1*]Assistant Lecturer of General and Laparoscopic Surgery, Faculty of Medicine, Minia University, Egypt; [2]Professor of General and Laparoscopic Surgery, Faculty of Medicine, Minia University, Egypt; [3]Professor of General and Laparoscopic Surgery, Faculty of Medicine, Minia University, Egypt; [4]Professor of Surgical Oncology, National Cancer Institute, Cairo University, Egypt; [5]Lecturer of Surgical Oncology Teacher, National Cancer Institute, Cairo University, Egypt.

Recent improvements of surgical technique and perioperative clinical care have reduced the morbidity and mortality after PD. However, PD for pancreatic head cancer, especially borderline resectable, remains a substantial challenge for most surgeons. [13] A safe and effective surgical technique designed especially for BRPHC is warranted to improve resection rates. [14] The criterion for BRPHC is whether the vasculature around the pancreas is involved. The most time-consuming and demanding step during pancreatic resection is dissection of this vasculature, which can result in severe intraoperative and postoperative bleeding.[15] The complexity of this portion of the procedure is demonstrated by the continuing efforts of many researchers to simplify it while maintaining its safety, which has resulted in such techniques as the artery-first approach,[16] no-touch isolation technique,[17] uncinate process-first approach,[18,19] and the hanging maneuver.[20,21]

In recent decades, to improve the R0 resection rate and control blood loss, many modifications of the standard PD have been implemented. Venous resection of PV/SMV if involved approved to be efficient technique in PD with the same survival equal to patients without vascular involvement. Despite some centers performing arterial resection in PD, the high morbidity and mortality associated with this technique leads to development of generalized conclusion of contraindication of arterial resection.So the major local contraindication now for surgery is arterial involvement (SMA, CELIAC, CHA) [22].

A technique called the artery first approach" aims to detect SMA, celiac trunk and hepatic artery early and to determine whether the tumor adjoined to the arteries is resectable before the point of no return (transection of the pancreatic neck or bile duct division) [23,24].

Furthermore, the "artery-first approach" highlights that systematic pancreatic mesenterium dissection surrounding the SMA achieves R0 resection of the posterior peritoneal margin [25]. Therefore, the SMA-first approach pancreaticoduodenectomy (SMAPD) may control operative blood loss and improve the rate of R0 resection.

A positive microscopic margin (R1 resection) is one of the poor prognostic factors [26,27] even after neoadjuvant treatment [28]. A careful dissection of the retroperitoneal margin close to the superior mesenteric artery is crucial as the latter is often invaded [29] and may be a criterion of non-resectability. The importance of an early intraoperative determination of resectability has led to the introduction of the "artery-first" approach in 2003.[30] The superior mesenteric artery-first posterior approach with "en bloc" retroperitoneal pancreatic tissue resection aimed to ascertain the resectability and to improve R0 resection rate.[31] The original technique was recently modified later, with the addition of a combined posterior and medial uncinate approach for an easier and safer surgical dissection.[32] Recent technological developments in computer-assisted image-guided surgery could well enhance the quality of oncologic surgical resection through patient-specific navigation tools based on virtual reality.[33] Medical imaging software can elaborate Digital Imaging and Communication in Medicine data to create a three-dimensional (3D) virtual model of the patient's anatomy.

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