

Use of a temporary intraoperative mesentericoportal shunt for pancreatic resection for locally advanced pancreatic cancer with portal vein occlusion and portal hypertension

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Background. Our aim was to evaluate the perioperative morbidity and survival of a selected group of patients with locally advanced pancreatic ductal adenocarcinoma (PDAC) and malignant obstruction of portal axis inducing portal hypertension (PH) who underwent a curative intent pancreatic resection, after neoadjuvant chemotherapy, adopting a new type of temporary intraoperative mesentericoportal shunt (TMPS).

Methods. We analyzed the perioperative data and survival outcome of 15 patients with locally advanced PDAC and PH who underwent pancreatoduodenectomy combined with vascular resections between October 2008 and October 2012 using this TMPS.

Results. There was no perioperative mortality. Postoperative morbidity occurred in 7 patients without any postoperative liver failure. All patients underwent mesentericoportal venous resection, 11 of whom had a concomitant arterial resection. The mean \pm SD follow-up was 16 ± 10 months (range, 4–40; median 15). Overall survival rates of patients were 78% and 11% at 1 and at 3 years, respectively. Median survival was 17 months. The 1-year disease-free survival was 36%.

Conclusion. The use of this form of TMPS allowed us to achieve PD or total pancreatectomy in patients with locally advanced PDAC and PH without postoperative mortality but with increased morbidity. The relevance of such an aggressive approach is yet to be determined. (*Surgery* 2014;155:449-56.)

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OPERATIVE RESECTION is considered the standard treatment in case of resectable pancreatic neoplasm and it provides the only chance for cure or long-term survival.¹⁻⁷ Pancreatic resection is indicated for patients with borderline resectable tumor with limited portal vein (PV) or superior mesenteric vein (SMV) involvement.⁴⁻⁷ For locally advanced pancreatic ductal adenocarcinoma (PDAC), and in particular for patients having

portal hypertension (PH) owing to malignant obstruction or total occlusion of the mesentericoportal venous axis, operative resection is contraindicated generally. The main reasons for excluding PDAC with PH from resection are both technical and oncologic. Such types of aggressive resection are technically demanding owing to the presence of extensive venous invasion with collateral circulation. In such conditions, dissection around the pancreas can be associated with major bleeding and may induce intestinal congestion and/or hepatic ischemia by interruption of portal inflow. From an oncologic perspective, the value of resection for PDAC with PH on survival has not been demonstrated.⁵ Some authors have proposed different types of passive or active shunts to temporarily reroute the portal circulation to decrease intraoperative complications of pancreatic resection⁸⁻¹¹; more recently, distal splenorenal and

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temporary mesocaval shunting.¹² Neoadjuvant chemotherapy has been advocated to “downstage” PDAC so as to allow resection.¹³

The aim of the present study was to evaluate the perioperative morbidity and survival of a selected group of patients with PDAC and PH treated by neoadjuvant chemotherapy who underwent a curative pancreatic resection adopting a new type of temporary mesentericoportal shunt (TMPS).

METHODS

Definitions and indications. PDAC were classified based on preoperative findings on computed tomography, and a recent consensus statement.⁴ Classification took into account tumor extension to the celiac trunk and/or the amount of tumor abutment to the superior mesenteric artery (SMA; $>180^\circ$ or $<180^\circ$) and/or the presence of PV involvement. Patients with PDAC were considered unsuitable initially for operation and received neoadjuvant chemotherapy whenever feasible. Preoperative radiotherapy was not considered in those patients owing to the potential risk of increased postoperative complications in case of major venous and/or arterial resection. For stable disease or an objective clinical response after neoadjuvant treatment, an attempt at resection was made if a curative intent resection (R0/R1) was considered achievable. PV invasion was classified in four groups according to Nakao et al⁸: Type A (no narrowing of the vein), type B (unilateral narrowing), type C (bilateral narrowing), and type D (venous occlusion). The TMPS technique was planned preoperatively on the base of computed tomography findings and used only in case of type C and D PV/SMV involvement owing to the presence of PH (Fig 1).

Pathologic analysis. All specimens were analyzed using a standardized, pathologic protocol using multicolor inking of the resection margins. The surgeon identified, in the operative room, the following 3 margins: (1) The PV–SMV margin; (2) the SMA margin; and (3) the posterior margin. Three different colors were used for inking.¹⁴ The resection was considered as curative (R0) if no tumor cells were identified at any of the resection margins.

Operative technique. The resectability of the pancreatic neoplasm was confirmed by examination of the abdominal cavity. Resection is contraindicated in cases of peritoneal carcinomatosis and liver metastases. The duodenum is mobilized with an extensive Kocher maneuver. The right colon, its mesocolon, and the root of the mesentery are completely mobilized. The right and medial parts

of the transverse mesocolon are transected at a mid-level, distal to Riolan’s arcade with ligation of middle colic artery and gastrocolic vessels. The SMV is identified and dissected in the root of the mesentery posterior to the transverse colon at a distance of ≥ 2 cm from the inferior edge of the tumor. Subsequently, the PV is exposed at the level of the hepatic pedicle. A TMPS is then performed by using a 20- to 30-cm long ringed Gore-Tex Graft with a diameter of 14–20 mm, based on the diameter of the SMV. The graft is inserted between the proximal stump of the SMV and the distal stump of the PV by 2 end-to-end anastomoses with 5/0 or 6/0 nonabsorbable monofilament running sutures. First, the SMV is clamped and divided and the venous stump on the specimen side is closed. The anastomosis between the SMV and the distal side of the prosthesis is performed first to preserve the portal flow to the liver from the splenic vein (SpV) as long as possible. Second, the hilar PV is clamped, divided, and the venous stump on the specimen side is ligated; the hilar PV is then anastomosed to the proximal side of the prosthesis. The prosthesis is purged by removing first the distal clamp from the SMV and then the proximal clamp is removed from the PV (Fig 2). A mean time of 20–30 minutes is needed to construct the TMPS without need of SMA clamping. In case of persistent left-sided PH after division of the SpV, a second shunt may be performed inserting a Gore-Tex graft between the SpV and the TMPS (Fig 3). After the decrease in portal pressure related to the TMPS, much less blood dissection around pancreas is started. The SMA is dissected to the left of the SMV. The soft tissue and lymphatic structures of the mesenteric root around the SMA and the SMV are totally resected. The pancreaticoduodenectomy with extended lymphadenectomy is completed as reported previously,^{6,7,14,15} and the specimen is removed en bloc with the involved segment of the PV/SMV. This extended pancreatoduodenectomy includes bilateral splanchnicectomy. In case of massive involvement of SMV, the TMPS is performed between the PV and the ileocolic vein, which will be the main effluent pathway of SMV. This ileocolic vein is dissected distally in the root of mesentery and anastomosed to the TMPS. In case of arterial invasion, arterial resection/reconstruction is performed at the end of the pancreas mobilization, just before removing the TMPS. Indeed, as well for isolated venous involvement, in such cases of arterial invasion of either the celiac trunk, hepatic artery, or SMA, dissection is performed as far as possible from the pancreas. The

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