

Distal Pancreatectomy with Celiac and Right or Left Hepatic Artery Resection without Arterial Reconstructions (Updated DP CAR). Anatomical and Clinical basis.

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BACKGROUND. Distal pancreatectomy with celiac artery (CA) resection (DP-CAR) is a justified option for treatment of pancreatic body ductal adenocarcinoma with CA involvement. Theoretically, risk of ipsilateral liver lobe ischemia after DP-CAR without arterial reconstructions increases in case of resection of the left (LHA) or right (RHA) hepatic artery.

AIM. To assess safety and oncological outcomes of DP-CARs with resection of one of the main hepatic arteries without arterial reconstructions ("updated" DP-CAR).

METHODS. Retrospective analysis of perioperative and survival data for six R0 "updated" DP-CARs. Liver arterial flow was assessed by IOUS and postoperative CT angiography.

RESULTS: Of 35 DP-CARs done, there were six cases of aberrant arterial anatomy, in which the left or right hepatic artery were excised with one vein resection. There were no mortality and ischemic complications. The main source of supply for "devascularized" liver lobe was the communicating interlobar or lesser gastric curvature arcade. Pancreatic fistula rate was 46%. Mean IO blood loss 230 (100-650)ml, mean operating time 259 (195-310)min., and mean LOS was 14(9-26)days. Median survival for PDAC was 24months after combined treatment. Three patients died at 26,28,77 months and others progression-free at 105,18,17 months after diagnosing.

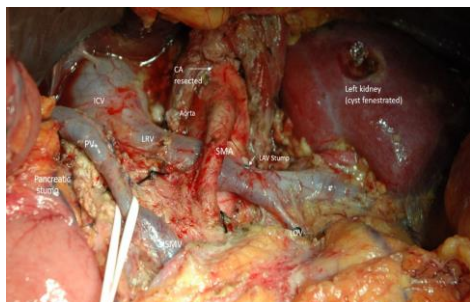


Fig.1 Intraoperative photo. The view of the operating field after R0 posterior RAMPS with the celiac artery (CA) resection without arterial reconstruction. Explanations in the text. SMA- superior mesenteric artery, PV-portal, SMV-superior mesenteric, LRV- left renal, LAV- left adrenal, LOV- left ovarian veins, ICV - inferior vena cava.

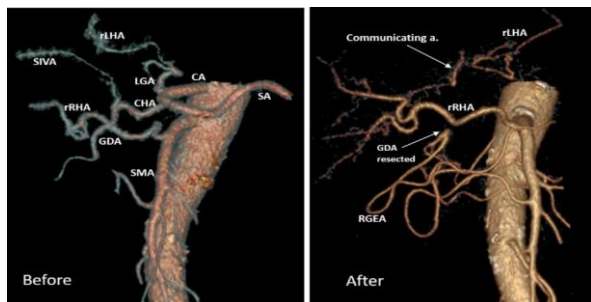


Fig 2. Ductal adenocarcinoma of the pancreatic body in 65-year-old female. Three-dimensional computed tomography angiography. **Before** surgery. Michel's IV arterial anatomy: the replaced right hepatic artery (rRHA) originating from superior mesenteric artery (SMA), the replaced left hepatic (rLHA) – from the left gastric (LGA) and segment IV artery (SIVA) originating from the common hepatic (CHA). CA: Celiac artery; GDA: gastroduodenal artery, RGEA – right gastroepiploic artery SA: Splenic artery; Communicating a. – artery, connecting right and left hepatic arteries. Eight years **after** DP-CAR with excision of the CHA and resection of the LGA, GDA and SIVA. Liver is supplied by the SMA through the rRHA, which communicating with the branches of the rLHA *via* interlobar collateral. Stomach is supplied from the SMA *via* pancreaticoduodenal arcade and, thereafter, through the gastroduodenal artery (GDA) and (RGEA).

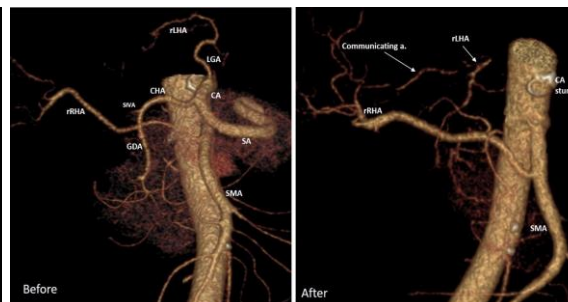


Fig 3. Gastric adenocarcinoma G2 with involvement of the pancreatic head and body in 66-year-old female. Three-dimensional computed tomography angiography. **Before** surgery. Michel's IV arterial anatomy: the replaced right hepatic artery (rRHA) originating from the superior mesenteric artery (SMA), the replaced left hepatic (rLHA) – from the left gastric (LGA) and the segment IV artery (SIVA) originating from the common hepatic (CHA). 20 months **after** total gastrectomy and total pancreatectomy (completion of the Appleby procedure due to positive margins) with resection of the celiac artery (CA), CHA, LGA, SIVA and gastroduodenal (GDA) arteries. Liver is supplied by the SMA through the replaced rRHA, communicating with the branches of the rLHA *via* interlobar collateral. SA: Splenic artery. Communicating a. – artery, connecting right and left hepatic arteries.

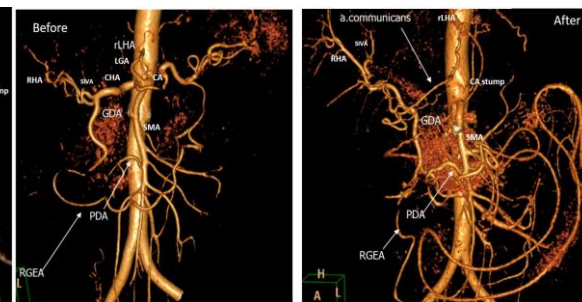


Fig 4. B-cell lymphoma of the pancreatic body and tail in 57-year-old female. Three-dimensional computed tomography angiography. **Before** surgery. Michel's II arterial anatomy: the replaced left hepatic artery (rLHA) originating from the left gastric (LGA). Five years **after** DP-CAR with excision of the common hepatic (CHA) and resection of left gastric (LGA) arteries. Left liver lobe is supplied *via* collateral communicating artery, which is presented here by the lesser curvature arcade between the proper or right hepatic artery (RHA) and the branches of rLHA. Stomach is supplied from the superior mesenteric artery (SMA) *via* pancreaticoduodenal arcade (PDA) and, thereafter, through gastroduodenal artery (GDA) and right gastro-epiploic artery (RGEA). CA: Celiac artery, RGEA: right gastro-epiploic artery. SIVA: segment IV artery (middle hepatic artery).

Conclusion: Updated DP CAR is an oncologically justified and safe procedure under conditions of reliable intraoperative liver and stomach ischemia monitoring



Fig 5. Ductal adenocarcinoma of the pancreatic body in 59-year-old male. Three-dimensional computed tomography angiography. **Before** surgery. Michel's I arterial anatomy with the right hepatic (RHA) originating from the celiac artery (CA). Twelve months **after** DP-CAR with excision of the common hepatic (CHA) and resection of the RHA. Resection lines are shown in yellow. The left liver is supplied from the superior mesenteric artery (SMA) *via* pancreaticoduodenal arcade (PDA) through the gastroduodenal (GDA) and left hepatic artery (LHA). The right liver is supplied *via* the interlobar collateral (communicating a.) which connects the LHA and RHA. Stomach is supplied from the SMA *via* PDA, GDA and right gastroepiploic artery (RGEA). Segment IV artery (SIVA), splenic artery (SA).



Fig 6. Ductal adenocarcinoma of the pancreatic body in 62-year-old female. Three-dimensional computed tomography angiography. **Before** surgery. Michel's II arterial anatomy: the replaced left hepatic artery (rLHA) originating from the left gastric (LGA). Twelve months **after** DP-CAR with excision of the common hepatic (CHA) and resection of the LGA, resection and reconstruction of PV-SMV confluence. The left liver lobe is supplied by the branches of the rLHA *via* collateral (Communicating a.) anastomosing with the branches of the segment IV artery and the proper hepatic artery. Stomach is supplied from the superior mesenteric artery (SMA) *via* pancreaticoduodenal arcade and, thereafter, through gastroduodenal artery (GDA) and right gastro-epiploic artery (RGEA).



Fig 7. Ductal adenocarcinoma of the pancreatic body in 70-year-old female. Three-dimensional computed tomography angiography. **Before** surgery. Michel's I arterial anatomy with the right hepatic artery (RHA) originating from the celiac artery (CA). Thirteen months **after** DP-CAR with excision of hepatic (HA) and resection of RHA. Resection lines are shown in yellow. The left liver is supplied from the superior mesenteric artery (SMA) *via* the pancreaticoduodenal arcade (PDA) through the gastroduodenal (GDA) and the left hepatic artery (LHA). Right liver is supplied *via* interlobar collateral (communicating a.) which connects the LHA, middle hepatic (MHA) and the RHA. The stomach is supplied from the SMA *via* PDA, GDA and the RGEA.