Correlation between resection margin involvement and CT patterns of recurrence of pancreatic adenocarcinoma after surgery

Poster No.: C-2187  
Congress: ECR 2016  
Type: Scientific Exhibit  
Authors: F. Lombardo¹, G. A. Zamboni¹, M. Bonatti², G. Marchegiani¹, R. Pozzi-Mucelli¹; ¹Verona/IT, ²Bolzano/IT  
Keywords: Abdomen, Pancreas, CT, Diagnostic procedure  
DOI: 10.1594/ecr2016/C-2187

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.  
As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method ist strictly prohibited. You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages. Please note: Links to movies, ppt slide shows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Aims and objectives

Pancreatic adenocarcinoma is a disease with a poor prognosis, mainly due to its late clinical presentation and limited response to chemo- and radiotherapy. Currently, surgical resection followed by adjuvant therapy represents the only potentially curative treatment for localized disease, increasing the 5-year overall survival from less than 5% to 10-20% [1-3]. Many prognostic factors have been identified in predicting long-term survival, like tumor stage, differentiation, nodal involvement, preoperative levels of CA 19-9, type of resection and adjuvant therapy [3-5]. The impact of microscopic margin involvement (R1) on the overall and disease-free survival is still debated and many studies do not report it as a significant prognostic factor, even though a trend of lower survival rates has been observed compared to R0 resections, especially in small tumors [5-7]. The majority of tumor recurrences occur in the first 2 years after resection as local recurrences, liver metastases or peritoneal dissemination [4]. MDCT and seriated levels of CA 19-9 are probably the most accurate and reliable approach in detecting pancreatic cancer recurrence, with a reported accuracy of 85% for MDCT, 95% for CA 19-9 and 100% for their combination [8]. The aim of our study was to identify common patterns of recurrence of pancreatic adenocarcinoma after major pancreatic surgery and to correlate them with surgical margin status after resection.
Methods and materials

Patient population: we considered for inclusion 68 patients who underwent follow-up CT after resection for pancreatic adenocarcinoma between July 2009 and December 2014. All patients underwent post-operative adjuvant chemo- and radiotherapy. Inclusion criteria were: presence of one CT with findings suggestive for local or distant recurrence of disease, availability of at least one subsequent contrast-enhanced examination and/or seriated serum levels of CA 19-9 (43/68). Our study population finally included 43 patients, 22 males and 21 females with a mean age of 66.6 years (range 40 - 84). For each patient, date and type of resection were logged. Surgical margin involvement was obtained by pathology reports.

CT scanner and protocol: all examinations were performed on a 64-row MDCT (Brilliance 64, Philips Medical Systems, The Netherlands) with a multiphasic protocol which included unenhanced, late arterial and portal-venous acquisitions, timed with a bolus-tracking technique. A region of interest (ROI) of 1 cm² was positioned by a technologist in the abdominal aorta at the origin of the celiac axis and multiple low-dose scans (50 - 75 mA) were performed after contrast injection. Late arterial and portal-venous phases were acquired respectively 15 and 60 seconds after a threshold of 150 HU was reached in the ROI. All patients received a weight-based (1.5 ml/Kg) amount of high-concentration contrast agent (Ultravist® 370, Bayer Schering Pharma, Germany) through an 18- or 20-gauge intravenous catheter placed in an antecubital vein, using an automatic power injector (Stellant Medrad, Indianola, PA, USA) at a flow rate of 4 ml/sec, followed by a 50 ml saline flush. All scans were obtained craniocaudally with the patient lying supine on the table, with the arms bended over his head whenever possible.

Image evaluation: CT images were evaluated on a workstation (Carestream Vue PACS Version 11.4), Carestream Health, Rochester, NY, USA) by one radiologist with 4 years of experience in abdominal imaging, using various reformatting techniques as needed, including MPR, MIP and MinIP. Disease recurrence was classified into local recurrence, lymph node recurrence, metastatic disease or peritoneal carcinomatosis. Local recurrence was defined by the presence of hypovascular tissue, either as a definite mass or as a diffuse infiltration, along the surgical bed, the pancreatic remnant, the anastomotic area or encasing the major peripancreatic vessels. Nodal recurrence was defined by the presence of lymph nodes with short axis # 10 mm. Every new focal lesion with specific imaging features in the liver, lungs or other organs was considered to be metastatic disease. Peritoneal carcinomatosis was defined by the presence of visible peritoneal nodules with or without ascites. Only the first sites of recurrence were documented. All CT findings were confirmed by subsequent contrast-enhanced examinations (CT or MRI), by increasing levels of CA 19-9 or by both. Histological confirmation was rarely obtained.
Results

33 tumors were located in the head, 10 in the body or in the tail. Mean and median intervals between surgery and recurrence at CT were respectively 458 and 337 days for the patients who had R0 resection (range 51 - 1907) and 242 and 205 days for R1-2 resection (range 44 - 536) (p=0.0737). 31 patients underwent pancreaticoduodenectomy, 10 patients underwent spleno-pancreasectomy and 2 patients underwent total pancreasectomy. 31 patients had a R0 resection (72%), 11 patients had a R1 resection (26%) and 1 patient had a R2 resection (2%). 18 patients presented with a local recurrence with solid tissue formation along the surgical margins and/or surrounding the main splanchnic vessels: of these, 14 had R0 resection, 3 had R1 resection and 1 had R2 resection (Figure 1 - 3). 21 patients had a lymph node recurrence: of these, 15 patients had R0 resection, 5 had R1 resection and 1 had R2 resection. 26 patients presented metastatic disease with hepatic metastases (n=16), pulmonary metastases (n=5) or both (n=5): of these, 17 had R0 resection and 9 had R1 resection. 7 patients presented peritoneal carcinomatosis; of these, 5 had R0 resection and 2 had R1 resection. In 5 patients local recurrence was the only manifestation of the disease, whereas in 7 patients it was associated with metastatic disease or peritoneal carcinomatosis. Metastatic dissemination was observed alone in 12 patients and in association with nodal involvement or peritoneal carcinomatosis in 9 cases. 4 patients presented peritoneal dissemination as the only manifestation of recurrence. No association was observed between R+ status and the presence of local recurrence, metastatic disease, nodal involvement or peritoneal dissemination (p=n.s.).
Fig. 1: Local recurrence after splenopancreasectomy. Normal pancreatic remnant 8 months after R0 resection (a, arrow) with patent superior mesenteric vein (a, arrowhead). Recurrence occurred 23 months after intervention with solid hypovascular tissue along the surgical bed (b, arrow) and surrounding the superior mesenteric artery (b, arrowheads). SMV is not detectable due to thrombosis.

© Istituto di Radiologia, Policlinico GB Rossi - Verona/IT

Fig. 2: Local recurrence after splenopancreasectomy. Pancreatic resection margin 3 months after R0 resection (a, arrow). Recurrence is clearly depicted 14 months after surgery as a solid hypovascular tissue (b, arrow) infiltrating the stomach (b, arrowhead).

© Istituto di Radiologia, Policlinico GB Rossi - Verona/IT
Fig. 3: Local recurrence after pancreaticoduodenectomy. Common hepatic artery has normal caliber 6 months after R1 resection (a, arrowhead). 2 months later hypovascular tissue is visible encasing and infiltrating the common hepatic artery (b, arrowhead).

© Istituto di Radiologia, Policlinico GB Rossi - Verona/IT
Conclusion

In oncology, a positive surgical margin is generally accepted as a poor prognostic factor, even though its impact on the overall and disease-free survival in pancreatic adenocarcinoma is controversial [5-7]. Our study focused on the relationship existing between resection margin status and pattern of recurrence detected at CT. The two major patterns were local recurrence and metastatic disease, alone or in association with one another. Despite R+ resections should theoretically be correlated with higher rates of local recurrence, in our series there were no differences in recurrence patterns between R+ and R- resections, as the proportion of patients with local, nodal, metastatic or peritoneal recurrence was similar in the two groups. Moreover, no significant differences were found in the disease-free intervals between R+ and R- resections, even though recurrences of any type tended to present earlier in the R+ group. These results should be partially explained by the systemic nature of pancreatic cancer, with metastatic spread often occurring early in the natural history of the disease. To our knowledge, only few papers considered the relationship between surgical margin status and patterns of recurrence, with mixed results. Raut et al [9] found that there were no differences in recurrence patterns between R+ and R- resections, whereas Sugiura et al. [10] concluded that a positive margin status increased the local recurrence rate. Moreover, autopsy series suggested that some local recurrences might be missed at CT, especially in patients who received local radiotherapy, and it cannot be determined whether distant metastases originate from unrecognized local recurrence or not [11]. In conclusion, our study shows that a positive surgical margin status is not correlated with a specific pattern of recurrence after resection, confirming pancreatic cancer as a poorly predictable and difficultly manageable disease.
References


7. Tummala P, Howard T, Agarwal B: Dramatic Survival Benefit Related to R0 Resection of Pancreatic Adenocarcinoma in Patients With Tumor $\leq 25$ mm in Size and $\leq 1$ Involved Lymph Nodes. *Clinical and translational gastroenterology* 2013, 4:e33.

