Differentiation between tumour recurrence and post-surgical fibrosis in patients resected for pancreatic adenocarcinoma

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Aims and objectives

Pancreatic adenocarcinoma is the most common neoplasm of pancreas, representing 85% of pancreatic malignant tumors, and it's the fifth most frequent malignancy in the adult. Its prognosis is very poor, with an estimated 5-years survival rate of 5%. The prognosis is related to the fact that most of tumors (95%) are detected in an advanced stage. The only potential curative treatment available for pancreatic cancer, when not contraindicated for the advanced stage, is surgical resection. Following resection, the 5-year survival rate of patients ranges from 10 to 25%. In fact, despite the application of an apparently curative surgery, the disease usually recurs. Ninety-five percent of tumor relapses occur within 2 years from the resection and the most common sites (97%) are intra-abdominal, especially local recurrence, hepatic or nodal. Computed tomography has proven to be the best imaging modality to detect recurrences in follow-up patients. Despite an estimated frequency of local recurrence of 35-65%, even after R0 resections, imaging of local recurrence is little described in the literature. A major problem in patients with pancreatic cancer is that extensive postoperative changes with scar tissue formation is present after resection in the surgical bed that may be mistaken for disease recurrence. Accurate detection of recurrent pancreatic cancer after surgery is important for assessing patient prognosis and monitoring the effectiveness of adjuvant therapies, and for selection of patients who may be candidates for additional therapy.

Purpose of this study was to assess the follow-up CTs of patients with resected adenocarcinoma of the pancreas to compare the features of postoperative fibrosis and of tumor local recurrence.
Methods and materials

Patient population

We reviewed the follow-up MDCTs of patients with resected adenocarcinoma of the pancreas performed between 2011 and 2017, and selected 42 consecutive patients with detection of solid hypodense tissue in the resection area at CT and with further follow-up imaging available. The study population included 22 males and 19 females with an average age at the time of the examination of 65.7 years.

CT imaging

MDTC examinations were performed using on a 64-row scanner (Philips Brilliance 64, Philips Medical System, Eindhoven, Netherlands). Patients received a weight-based amount of iodinated contrast agent (1.5 ml/kg, Ultravist 370, Bayer Schering Pharma, Germany). A late-arterial phase and a venous phase were acquired, timed with bolus-tracking with 15-seconds and 60-seconds post-threshold delay, respectively.

Image analysis

Two readers with experience in abdominal imaging reviewed in consensus the scans. The readers measured the longest diameter of the solid tissue. They measured the attenuation of the solid tissue by drawing ROIs on the slice with the largest diameter in the late-arterial and in the venous phase. They also assessed for the presence of metastases, pathological lymph-nodes, and peritoneal carcinomatosis.

The absolute (HUven-HUart) and ratio of enhancement (HUven-HUart/HUart) were calculated.

Statistical analysis was performed including t-test and Fisher’s test.
Results

Among the 42 patients, follow-up MDTCs showed 19 patients with local recurrence and 22 patients with post-surgical scar tissue which remained stable for size and imaging features. Average age at the time of examination was 66 for the local recurrence group and 65.4 for the scar tissue group.

Mean longest diameter of the post-surgery solid tissue in patients with tumor recurrence was $35.5 \pm 4.8$ mm, significantly larger than $21.4 \pm 1.6$ mm measured in patients with stable fibrosis ($p=0.0053$).

<table>
<thead>
<tr>
<th></th>
<th>RECURRENCE</th>
<th>FIBROSIS</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAN LONGEST DIAMETER</td>
<td>$35.5 \pm 4.8$ mm</td>
<td>$21.4 \pm 1.6$ mm</td>
<td>0.0053</td>
</tr>
<tr>
<td>MEAN ABSOLUTE ENHACEMENT</td>
<td>$10.97 \pm 0.77$ HU</td>
<td>$21.43 \pm 1.46$ HU</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>ENHANCEMENT RATIO</td>
<td>$+26.14%$</td>
<td>$+72.15%$</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

Mean absolute enhancement from the arterial phase to venous phase (HU\text{ven}-HU\text{art}) was $10.97 \pm 0.77$ HU for tumor recurrence and $21.43 \pm 1.46$ HU for fibrotic tissue ($p<0.0001$). The enhancement ratio was $+26.14\%$ for the former and $+72.15\%$ for the latter ($p<0.0001$). No significant difference was observed between the two groups for the presence of metastases, pathologically enlarged lymph-nodes or peritoneal carcinomatosis.
**Fig. 1:** Late-arterial phase MDCT scan in a resected patient with local recurrence. The ROI drawn on the solid mass in the surgical bed shows mean attenuation value of 24,14 HU

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**Fig. 2:** Venous phase in the same patient showed in Fig. 1. The ROI drawn on the solid mass shows mean attenuation value of 36.49 HU.

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**Fig. 3:** Late-arterial phase MDCT scan in a resected patient with stable scar tissue. The ROI drawn on the solid mass in the surgical bed shows mean attenuation value of 59.57 HU.

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**Fig. 4:** Venous phase in the same patient showed in Fig. 3. The ROI drawn on the solid mass shows mean attenuation value of 92.94 HU.

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Fig. 5: Mean longest diameter of the post-surgery solid mass

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Fig. 6: Mean absolute enhancement (HUven-HUart) of the solid mass form late-arterial phase to venous phase.

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**Fig. 7:** Enhancement ratio (HU_{ven}-HU_{art}/HU_{art}) of the solid mass from late-arterial phase to venous phase.

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Conclusion

In conclusion, these preliminary results showed that tumor recurrence appears to be larger in size and with poorer progressive enhancement than post-surgical fibrosis. Local recurrence appears to have no correlation with the presence of metastases, pathological lymph-nodes and peritoneal carcinomatosis. These results are going to be confirmed assessing a larger group of resected patients.
Personal information

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