to-voxel mapping between the initial planning scan and the treatment scan. Therefore, deformation maps can be applied to propagate contours from planning CT to daily images, but also to compute dose distribution from the deformed images for dose accumulation purpose.

In this presentation, we will describe the general framework of deformable image registration, and will cover the main class-solutions for registration-based recontouring according to the tumor location and the available imaging modality, i.e. kV- or MV/CB-CT. Typical adaptive workflows based on deformable registration will be presented, as well as their advantages and potential limitations. Last, we will emphasize the essential role of the operator for accuracy and consistency check of the deformed contours, any inaccuracy in this step necessarily introducing systematic errors in the planning process.

**SP-0117**
Clinical application of atlas-based autosegmentation for contouring of multiple treatment sites
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In the Erasmus MC radiotherapy department, atlas-based auto-segmentation of both clinical target volumes and organs at risk (OARs) is an important time-saving tool in daily clinical routine to assist both physicians and technicians. The accuracy of delineations has become increasingly important due to enhanced conformity of dose distributions as realized by IMRT and VMAT, and the use of reduced PTV margins in combination with image guidance. Clinical validation of atlas-based auto-segmentation for head-and-neck patients showed a reduction of hands-on time for delineation from 180 to 66 minutes, where structures were evaluated as ‘minor-deviations, editable’ or better (D. Teguh; Int. J. Radiation Oncology Biol. Phys., Vol. 81, No. 4, pp. 950-957, 2011). The influence of geometric differences between autocontours and manual delineations by different observers on the dosimetric impact can differ for CTV and for OAR (Voet PW, Radiother. Oncol. 2011 Mar;98(3):373-7). We clinically implemented Admire (Elekta AB, Sweden) as part of our workflow in 2010. In this workflow, critical review and editing of the autocontours is still relevant.

For several target sites, a database was created containing fully contoured reference CT data sets (atlases). Depending on the tumor site, one or more atlases are used as an input for the generation of the patient-specific delineation (using the staple algorithm). The strategy of a single atlas can particularly be useful in case of adaptive treatments, resulting in a quick and more accurate autocontouring using the original delineated patient CT as the only atlas. An overview of the clinical implementation of Admire with regard to several tumor sites and the relation to treatment techniques such as breath-hold will be presented.

**Results:**
Median follow-up (FU) was 27 months (2-225). At univariate analysis there was a strong impact of prCA19.9 classes (0.0-5.0, 5.1-37.0, 37.1-100, 100.1-353.0, >353.1) on 5-years OS (5.7% vs 37.9 vs 27.1 vs 17.4 vs 10.9, p= 0.008), 5-years DMFS (17.0% vs 46.0% vs 39.0% vs 26.7 vs 23.4, p=0.001), respectively. Only in pts with prCA 19.9 >353.1 U/ml aCT had positive impact on 5-year OS (47.4% in pts treated with aCT vs 30.2% in pts not treated with aCT, p= 0.006). At multivariable model, sub-analysis of 404 pts showed (Table 1): worse OS for grading 3 tumor (HR: 1.85 95%CI: 1.26-2.70, p= 0.002) tumor diameter > 30 mm (HR: 1.85, 95%CI: 1.35-2.53, p< 0.001), and better OS for pts treated with RCT doses > 50 Gy (HR: 0.38, 95%CI: 0.23-0.63, p< 0.001), Median OS worsened in pts with prCA19.9 >100 and <353 (HR: 1.77, 95%CI: 1.23-2.56, p=0.002) and in pts with prCA19.9 ≥353.1 (HR: 1.92, 95%CI: 1.34-2.76, p<0.001).

**Purpose or Objective:** Preoperative level of CA 19-9 (prCA19.9) predicts survival of patients (pts) undergoing surgery for pancreatic adenocarcinoma (PAC). Actually, there is no evidence of using prCA19.9 as a marker customizing and modulating effectiveness of adjuvant treatment or predicting pattern of failure. Therefore, the purpose of this pooled analysis was to determine whether prCA19.9 could predict overall survival (OS), local control (LC), disease metastasis free survival (DMFS) and evaluate effectiveness of adjuvant therapies in a broad population.

**Material and Methods:** We performed a multicenter retrospective analysis of 1122 patients (pts) who underwent surgical resection +/- adjuvant treatment [chemotherapy (aCT), radiotherapy +/- concomitant CT (RCT)] for PAC between 2000 and 2014 from 8 different institutions. Among 700 pts with prCA19.9 value we applied the Kaplan-Meier method and the log-rank test to investigate differences in OS, LC, DMFS between defined groups based on: clinical and pathological factors, 4 prCA19.9 cutoff (5, 37, 100, 353) and 5 relative prCA19.9 classes (0.0-5.0, 5.1-37.0, 37.1-100, 100.1-353.0, >353.1). We fitted Weibull regression model with shared frailty on institution to identify independent predictors of OS using data from 404 pts with complete information. We applied a backward stepwise strategy to select the covariates, forcing CRT and RT in the final model.

**Results:**
Median follow-up (FU) was 27 months (2-225). At univariate analysis there was a strong impact of prCA19.9 classes (0.0-5.0, 5.1-37.0, 37.1-100, 100.1-353.0, >353.1) on 5-years OS (5.7% vs 37.9 vs 27.1 vs 17.4 vs 10.9, p= 0.008), 5-years DMFS (17.0% vs 46.0% vs 39.0% vs 26.7 vs 23.4, p=0.001), respectively. Only in pts with prCA 19.9 >353.1 U/ml aCT had positive impact on 5-year OS (47.4% in pts treated with aCT vs 30.2% in pts not treated with aCT, p= 0.006). At multivariable model, sub-analysis of 404 pts showed (Table 1): worse OS for grading 3 tumor (HR: 1.85 95%CI: 1.26-2.70, p= 0.002) tumor diameter > 30 mm (HR: 1.85, 95%CI: 1.35-2.53, p< 0.001), and better OS for pts treated with RCT doses > 50 Gy (HR: 0.38, 95%CI: 0.23-0.63, p< 0.001), Median OS worsened in pts with prCA19.9 >100 and <353 (HR: 1.77, 95%CI: 1.23-2.56, p=0.002) and in pts with prCA19.9 ≥353.1 (HR: 1.92, 95%CI: 1.34-2.76, p<0.001).

**Figure 1:** Impact of prCA19.9 on OS

**PV-0118**
Prognostic impact of presurgical CA 19-9 level in pancreatic adenocarcinoma; a pooled analysis.
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**Poster Viewing:** 3: Clinical: Gastrointestinal and gynaecology

**Figure 2:** Impact of prCA19.9 on OS
Conclusion: PrCA19.9 was a marker predicting OS and pattern of failure. ACT had positive impact on 5-year OS in pts with prCA19.9 > 353.1 U/ml. Our results suggest that prCA19.9 should be included in predictive models in order to customize treatments basing on prognostic factors of individual pts. Innovative treatments should be tested especially in pts with high prCA19.9 value.

PV-0119 Pattern of regional recurrence in adenocarcinoma of GEJ: implication for target delineation

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Purpose or Objective: To investigated the frequency and location of regional recurrence of locally advanced adenocarcinoma of GEJ patients after curative resection and refine the clinical target volume (CTV) delineation of radiotherapy.

Material and Methods: From 2009 to 2013, we retrospectively reviewed 1140 esophagogastric cancer patients treated in our institute. Patients who had curative resection, and were histopathologically diagnosed with locally advanced adenocarcinoma of GEJ (T3/4 or any N+) and confirmed of regional recurrence in follow-up CT images were selected into the analysis. First regional recurrence was recorded and one diagnostic radiologist with specialty of gastrointestinal tract investigated. The frequency and location of regional failure at each node station were analyzed according to Siewert types. Reference CT images was obtained from a healthy volunteer. We then delineated the epicenters of recurrence sites at the equivalent location, based on the same vessels of reference CT images compared with the recurrence CT images on Pinnacle treatment planning system. The combined contour of all recurrence sites was presented on a digitally reconstructed radiograph (DRR) image.

Results: Regional recurrence was identified in 78 patients. The majority of recurrence occurred within 2 years of follow-up (Median, 10.9 months). Of all, 35 (44.9%) patients were regional node failure (NF) only, 24 (38%) experienced regional NF simultaneous with distant failure, 11 (14.1%) were locoregional, and 8 (10.3%) had concurrent distant and locoregional failure. The most common recurrent lymph nodes station were No.16 (62.8%), No. 9 (32.1%), No. 11 (24.4%), No. 8 (17.9%), No. 7 (16.7%), No. 112 (12.8%), No. 4 (12.8%) and No. 12 (10.3%), respectively. 11 patients (14.1%) had recurrence at mediastinal lymph nodes. There was significant difference of NF in No. 9 (42.2% vs 18.2%, P=0.027) between Siewert type II and III AEG, but no difference was observed in the other node stations. Different frequency and location of regional recurrence were shown by CT and digitally reconstructed radiograph (DRR) images. A three-dimensional (3D) atlas based on vessel delineation and distribution of regional recurrence was established.

Conclusion: The most prevalent nodal recurrence in patients with adenocarcinoma of GEJ after curative resection was along the abdominal aorta, celiac artery and splenic artery.

Our findings suggest a modified elective lymphatic nodal target volume for IMRT contours in those patients.

PV-0120 Gastric fundus irradiation increases risk of postoperative anastomotic leakage in esophageal cancer

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Purpose or Objective: Concerns have been raised regarding the toxicity of neoadjuvant chemoradiotherapy (nCRT) for esophageal cancer that could contribute to an increased risk of complications after subsequent esophagectomy such as anastomatic leakage. In this respect, radiation dose to the gastric fundus is of interest as this part of the stomach is used for the esophagogastrectomy after esophagectomy. The aim of this study was to determine the influence of neoadjuvant radiation dose to the gastric fundus on the risk of postoperative anastomotic leakage in patients with esophageal cancer undergoing nCRT followed by transthoracic esophagectomy.

Material and Methods: Between 2012 and 2015, 97 consecutive patients with esophageal cancer who underwent nCRT followed by transthoracic esophagectomy with cervical anastomosis were analyzed. The nCRT regimen consisted of a total radiation dose of 41.4 Gy in 23 fractions of 1.8 Gy in 5 weeks combined with weekly intravenous administration of carboplatin and paclitaxel. The gastric fundus was retrospectively contoured on the pre-treatment planning CT. Within this contour, dose-volume histogram parameters were calculated and univariable and multivariable logistic regression analyses were used to determine their influence on the risk of anastomotic leakage.

Results: In 25 patients (26%) anastomotic leakage occurred. The mean radiation dose to the gastric fundus was significantly higher in patients with versus without anastomotic leakage (median [Interquartile range]: 35.6 Gy [20.2-39.9] versus 24.9 Gy [11.9-35.1], respectively; p=0.047). A mean dose above versus below 31.4 Gy was associated with leakage rates of 43% versus 15%, respectively. Two typical examples of dose distributions in relation to the gastric fundus in patients with and without anastomotic leakage are depicted in Figure 1. Adjusted for potential confounders including tumor location, clinical T-stage and radiation modality, the mean radiation dose to the gastric fundus remained significantly and independently associated with an increased risk of anastomotic leakage in multivariable analysis (adjusted odds ratio 1.05 per 1 Gy increase, 95% confidence interval: 1.003-1.10, p=0.035).

Also, in patients with anastomotic leakage the minimum radiation dose, V25, V30 and V35 to the gastric fundus were significantly higher (Table 1).

Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
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<td>Radiation dose (Gy)</td>
<td>24.9</td>
<td>35.6</td>
<td>20.2-39.9</td>
<td>&lt;0.045</td>
</tr>
<tr>
<td>V25 (Gy)</td>
<td>24.2</td>
<td>31.4</td>
<td></td>
<td>&lt;0.045</td>
</tr>
<tr>
<td>V30 (Gy)</td>
<td>29.9</td>
<td>34.7</td>
<td></td>
<td>&lt;0.045</td>
</tr>
<tr>
<td>V35 (Gy)</td>
<td>33.7</td>
<td>38.7</td>
<td></td>
<td>&lt;0.045</td>
</tr>
</tbody>
</table>

Our findings suggest a modified elective lymphatic nodal target volume for IMRT contours in those patients.

Figure 1. Examples of pre-treatment planning CT scans with dose distributions in (A) a patient who developed postoperative anastomotic leakage after receiving a mean dose to the gastric fundus of 41.2 Gy, and in (B) a patient who did not experience postoperative anastomotic leakage after receiving a mean dose to the gastric fundus of 19.4 Gy.