delineated the BP 3 times, every time with an interval of 2 weeks. A detailed statistical analysis was performed on 4 subregions of the BP. The first region extends from the exit of the BP through the intervertebral foramina until the entrance of the scale nerve opening. The second region ends at the entrance between the subclavius and serratus anterior muscles. The third region was defined between the subclavius and serratus anterior muscles. The fourth region defines the BP bordered by the minor pectoral, subscapular and serratus anterior muscles. The delineation accuracy was determined by measuring the BP inclusion of the delineations on rigidly fused CT-MRI datasets.

Results: A low inter- and intraobserver reliability was observed. The mean inter- and intraobserver kappa was respectively 0.29 and 0.45. The minimum and maximum Jaccard index in the interobserver group was 0.004 and 0.636 while in the interobserver group 0 and 0.124 was obtained. The total agreement volume in both intra- and interobserver groups was much lower than the union volume. The overall accuracy was poor, with an average inclusion of 38% (Figure 1). The accuracy of the delineations reduced from the medial to the lateral BP regions.

Conclusions: Poor inter- and intraobserver reliability of the RTOG-endorsed BP contouring guidelines was observed. Accuracy analysis showed an average BP inclusion of 38%. BP inclusion reduced from the medial to the lateral BP regions. Insufficient accuracy and reliability of the RTOG-endorsed BP guidelines was observed.

Table 1 RTOG-endorsed brachial plexus contouring guidelines

<table>
<thead>
<tr>
<th>Region</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Green</td>
</tr>
<tr>
<td>2</td>
<td>Red</td>
</tr>
<tr>
<td>3</td>
<td>Blue</td>
</tr>
<tr>
<td>4</td>
<td>Orange</td>
</tr>
</tbody>
</table>

Figure 1 Delineation of the brachial plexus (BP) by one observer on a cadaver dataset. In this example the delineation shows a 38.43% BP (yellow) inclusion. The defined subregions: region 1: green, region 2: red, region 3: blue, region 4: orange.

OC-0560
FIESTA MRI to investigate CSF around lower cranial nerve roots; implications for radiotherapy planning
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Purpose/Objective: Radiotherapy is a critical treatment for both medulloblastoma and ependymoma. The literature does not assess whether or not to include the roots of posterior fossa cranial nerves (CN’s - VII-XII) in the target volume. There is also little data describing the anatomy of cerebrospinal fluid (CSF) as it flows through the respective skull base foramina. The role of MRI, in particular steady-state free precession sequences such as FIESTA, in imaging the cisternal segments of CN’s, is well described. This study aims to determine whether a database of FIESTA images can be used to answer this anatomical question and whether this data can be used to guide radiotherapy planning.

Materials and Methods: A database of 97 FIESTA sequences of the posterior fossa was reviewed. Examinations were excluded for these reasons; sagittal reconstructions only, abnormal head shape/anatomy, no FIESTA sequences, limited number of slices pulled from archive, structure not clearly visualized. Measurements were made on the following number of scans for each foramen respectively; 86 left internal acoustic meatus (IAM), 84 right IAM, 83 left jugular foramen (JF), 85 right JF, 42 left hypoglossal canal (HC), 45 right HC. A protocol was written to describe how measurements should be taken. One author, a senior trainee in radiation oncology (observer 1), measured all available images. Another, a consultant radiologist (observer 2), measured distances for the first 5 patients on the database giving 30 data points for comparative analysis.

Results: Measurements of the HC were difficult and unreliable therefore only measurements of IAM and JF were used for comparison between 2 observers. The mean distances for observers 1 and 2 respectively were 12.4mm and 12.0mm (IAM) and 8.0mm and 7.8mm (JF). Differences between measurements were normally distributed; a Band-Altman analysis was used to assess agreement. A bias of +0.3mm was found for observer 1 relative to observer 2. The 95% confidence interval for disagreement was -0.4mm to 1.05mm; this was felt to be clinically acceptable. The mean distances of CSF flow in the sample were 12.2mm (95% CI 8.8 – 15.6mm) for IAM and 7.3mm (95% CI 4.0 – 10.6mm) for JF. The distribution of data for the HC was bimodal with peaks around 2-4mm and 8-10mm, precluding useful analysis. This was because many scans stopped around or just beyond the HC’s, resulting in poor image quality. We surmise that longer measurements come from scans where the HC was fully included.

Conclusions: FIESTA MRI gives excellent views of the posterior fossa CN foraminae and the CSF within. Measurement of these spaces is robust and reproducible. We intend to use these data to analyse previous treatment plans for both medulloblastoma and ependymoma and investigate whether specific voluming of these structures has any impact on target coverage and whether the CSF in these spaces may have been under-treated.

OC-0561
Hypothesis-generating prospective study for auto-delineation in lung tumors: READY LUNG-01
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Purpose/Objective: READY (REsearch program in Auto Delineation sYstem)-LUNG01 is an hypothesis-generating prospective study, which has the aim to validate in clinical
Materials and Methods: 20 patients with histologically proven lung lesions between 2010 and 2014 (primitive or secondary) treated at our Institution with SBRT or 3D conformal Radiotherapy (3DCRT) were retrospectively collected.

- 13 patients with primary lung cancers or lung metastases (9 patients with stage I lung cancer, 3 patients with lung metastases from rectal adenocarcinoma).
- 7 patients with locally-advanced-lung-cancer stage II-III were also selected to test the software with larger volumes.

Nodal Volumes were not taken into consideration Two Radiation Oncologists (RO) expert in lung cancers agreed the delineation of the lung lesions (Master Contour, MC). Two different RO performed the Automatic Delineation (AD) of the same lesions using the beta version of the SmartSegmentation-Knowledge-Based-Contouring 13.5, Varian Medical Systems. The 2 expert RO edited the automatic contour after a month, drawing Edited Delineation (ED).

The obtained contours (AD and ED) were compared to MC. Comparisons were made in terms of geometrical overlap, by analyzing:

Mean Dice-Similarity-Index (mDSI), Mean-Slicewise-Hausdorff-Distances (MSHD) and Volume difference (cc).

Results: The analysis of the contouring settings showed:

1) MC vs AD: mean mDSI=0.78 (1SD±0.13); a MSHD=13.48mm (1SD±13.92) and a mean volume difference=4.06cc (1SD±18.94).

2) MC vs ED mean mDSI=0.83 (SD±0.08); a MSHD=2.27mm (SD±3.39) and a mean volume difference=6.65cc (SD±18.89). When comparing the two groups a statistically significant greater concordance between MC vs ED than MC vs AD for DSI (p=0.0046) and for MSHD (p)

A qualitative analysis showed that for the early stages/metastases lesions the software had a good performance (Fig 1). The most significant differences between the 2 contours were have been observed at the lung bases, when lesions are close to the hepatic dome, and with hilum nodules due to structures isodensity.

Conclusions: The tested autosegmentation software seems promising in the automatic delineation of lung lesions both for SBRT or 4DRT purposes and for 3DCRT in more advanced stages, offering an acceptable overlap with expert drawn contours, although human expert revision is always warranted.

Investigations are ongoing on a larger number of patients to define a benchmark for early stage tumor/metastases and for locally advanced stages.

Purpose/Objective: The prognosis of patients with stage II-III non-small cell lung cancer (NSCLC) treated with concurrent chemoradiation (CCRT) remains poor. Tumour response monitoring over the course of CCRT with 18F-fluorodeoxyglucose (FDG) PET/CT has the potential to adapt the radiation therapy plan to biological parameters. Frequent FDG PET/CT scanning, however, is associated with radiation exposure to the patient and personnel involved in daily treatment. We therefore designed and implemented a weekly PET/CT scan protocol using a low dose FDG. The aim of this evaluation concerned logistics, safety and patient burden of using weekly low dose FDG PET/CT during CCRT.

Materials and Methods: Stage II-III NSCLC patients with no previous malignancies within the last 3 years, scheduled for 24 x 2.75 Gy with daily low dose cisplatin, were eligible for inclusion. Five weekly PET/CT scans (Philips Gemini Big Bore ToF) of the tumour and regional lymph nodes in treatment position were made over the course of treatment (just before each fraction) and at 3 months after CCRT, each with 50 MBq FDG, a total scan time of 14 minutes, and two bed positions. The image quality of the PET/CT scans was evaluated visually and by signal-to-noise levels. The radiation exposure was assessed for patients and for staff. Finally, the logistics of the procedures in all involved departments was evaluated.

Results: Thirteen patients were included of which ten completed the treatment and imaging course. A patient example is given in figure 1. One patient was excluded because a different radiotherapy scheme was chosen due to dose constraints, one patient demonstrated progressive disease on the PET/CT in week 1 and received altered treatment, and one patient found the extra imaging too demanding. The image quality of low dose FDG PET at baseline and during treatment was visually identical to routine diagnostic procedures, and had similar resolution and signal-to-noise levels. The radiation exposure of patients was about 20 mSv for the six scans in total. Following training on handling of radioactive patients in the departments of radiation oncology and medical oncology, involved staff did not receive a significant radiation dose (estimated < 1µSv per treatment). Planning logistics of 6 PET/CT scans linked to CCRT required close collaboration and dedicated imaging time slots. Patients typically spend 1.5 hours longer in hospital on days of PET/CT scans.

Figure 1: PET/CT axial image and 3D rendering image of the three performed contour settings.