uncertainty. Our data recommend daily kV CBCT imaging and setup corrections for this group of patients.

PO-0895
Intraprostatic calcifications as IGRT fiducial markers: analysis of 646 CBCT images in 35 patients
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Purpose or Objective: To review CBCT images of 35 pts receiving radical irradiation for localized prostate cancer, according to an IGRT protocol based on the use of intraprostatic calcifications as natural fiducial markers for the evaluation of inter-fraction organ motion.

Material and Methods: Between 2013 and 2014, 646 KVCBCT images of 35 pts radically irradiated with moderately hypofractionated VMAT (2.5 Gy/fract. × 70 Gy in 28 fract.) for localized prostate cancer were acquired according to an IGRT protocol aimed at evaluating the role of intraprostatic calcifications as natural fiducial markers. All the evaluated pts presented at least 3 calcifications of >2 mm located inside or at the borders of the CTV and contoured on high resolution CT-simulation scans and on each CBCT (mean: 18 CBCT/patient). In order to assess the internal stability of the calcifications the distances between them were measured for each patient on both CT-simulation scans and each CBCT, then mean ± SD of differences between distances was calculated. Distances between calcifications and the center of mass of CTV were also calculated in 21 patients by drawing CTV on 360 CBCT images, contoured by a same physician. The center of CTV mass spatial coordinates (X, Y, Z) was determined for each CTV and finally the distances between the center of the CTV and the center of each calcification were measured. Stability of calcifications in respect of CTV was assessed by calculating mean values ± SD of measured distances.

Results: The mean value of differences in distances between calcifications was -0.04 mm ± 1.54 SD, with 95% of values contained inside 3 mm (μ ± 2SD). The mean value of differences in distances between calcifications and center of mass of CTV (Fig 1) was -0.03 mm ± 1.55 SD, with 95% of values contained inside 3 mm (μ ± 2SD).

Conclusion: Our results derived from the analysis of a large data set of CBCT images confirm that intraprostatic calcifications, when >2 mm and present at least Nc=3, properly selected and contoured, can be used as very reliable natural fiducials, with potential reduction of iatrogenic risks and costs associated with the implantation of fiducial markers for prostate cancer IGRT.

PO-0896
The effect of bladder volume on bowel dose in the treatment of anal cancer using IMRT
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Purpose or Objective: Bony anatomy is used to match anal cancer patients treated using volumetric modulated arc therapy (VMAT). Only extreme volume changes due to bladder, rectum or bowel filling are currently highlighted to the responsible clinician. This study aims to determine the impact that changes in bladder volume has on the dose to the small bowel over the course of the treatment by comparing the dose to volumes outlined on cone-beam CT (CBCT) to the initial planned dose statistics. A more representative value of accrued dose to the small bowel over the course of treatment can also be gained.

Material and Methods: Ten patients who were treated with VMAT for anal cancer were selected for this study. Weekly cone beam CT images were acquired to monitor extreme changes in bladder and rectum filling. Patients were asked at both planning CT and treatment to have a comfortably full bladder. The bladder and small bowel (contained within the scan) were outlined on three CBCTs by one clinician; week one, mid treatment and final week. The bladder volumes were compared over the course of the treatment and the maximum small bowel dose, amount of small bowel receiving 30Gy (V30Gy) and 40Gy (V40Gy) were recorded.

Results: The results in Table 1 show the variation in bladder volume. The V40Gy bowel volume was plotted against the difference between the bladder volume at CBCT and the initial planning CT scan) were outlined on three CBCTs by one clinician; week one, mid treatment and final week. The bladder volumes were compared over the course of the treatment and the maximum small bowel dose, amount of small bowel receiving 30Gy (V30Gy) and 40Gy (V40Gy) were recorded.

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Conclusion: In eight cases a smaller bladder at CBCT resulted in a greater volume of small bowel receiving clinically relevant doses compared to the initial planning CT. There were two patients where the trend indicated that a larger bladder increased small bowel dose. Limitations of this study
include poor visibility of the small bowel on the CBCTs, smaller field of view meaning less volume and variation between initial planning clinician and clinician outlining CBCTs. CBCT is now widely used for adaptive planning techniques and in this case has provided evidence for implementing a stricter bladder filling protocol to improve the accuracy of bowel dose statistics at planning.

PO-0897
Comparison of hippocampus sparing extent according to the tilt of a patient head during WBRT
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Purpose or Objective: We report the results of our investigation into whole brain radiotherapy using linear accelerator-based intensity-modulated radiation therapy and volumetric-modulated arc therapy in cancer patients with a high risk of metastasis to the brain. Concretely, we assessed the absorbed dose and the rate of adverse effects for several organs at risk according to the tilt of a patient’s head.

Material and Methods: From data regarding patients who had previously received WBRT, we arbitrarily selected five cases where measurements were made with the patients’ heads tilted forward and five cases without such tilt. We set the entire brain as the planning target volume, and the hippocampi, the lenses, the eyes, and the cochleae as the main OAR, and formulated new plans for IMRT (coplanar, non-coplanar) and VMAT (coplanar, non-coplanar). Using the dose-volume histogram obtained from the treatment plans, we calculated and compared the effective uniform dose and normal tissue complication probability of the OAR. In order to compare the extent of hippocampal sparing, we also analyzed the mean and the maximum doses.

Results: When a patient received coplanar IMRT with the head tilted forward, the EUD and NTCP values for the hippocampus decreased by 13% and 81%, and the mean dose and maximum dose decreased by 8% and 7%, respectively. For coplanar VMAT treatment, the EUD values decreased by 2% and 13%, and the mean dose and maximum dose decreased by 2% and 4%, respectively. For non-coplanar treatment as well, the EUD values decreased by 14%, the NTCP values decreased by 81%, and the mean dose and the maximum dose decreased by 14% and 10%.

Conclusion: If the patient tilted the head forward when receiving the Linac-based treatment, for the same treatment effect in the PTV, we confirmed that a lower dose entered the OAR, such as the hippocampus, eye, lens, and cochlea. Also, the damage to the hippocampus was expected to be the least when receiving non-coplanar VMAT with the head tilted forward, and we showed that damage to OAR, including the hippocampus, was the least overall when the head was tilted forward. Accordingly, if patients tilt their heads forward when undergoing Linac-based WBRT, we anticipate that a smaller dose would be transmitted to the OAR, resulting in better quality of life following treatment.

PO-0898
Inter-fraction position of the tongue in postoperative radiotherapy of tongue cancer
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Purpose or Objective: Postoperative radiotherapy (PORT) of tongue cancer is associated with side-effects such as acute mucositis. Our department previously used intraoral stents to depress the tongue to minimize the dose to the palate. However, the stents were not always very well tolerated and there were also reproducibility issues. Therefore, the intraoral stents were omitted. In order to still ensure target coverage, we have included the air gap (if present) above the tongue in the target volume (CTV tongue including the surgical bed) on the planning CT. We wanted to investigate whether the air gap is a systematic phenomenon over all treatment fractions, so that the size of the CTV could be reduced avoiding irradiating the palate.

Material and Methods: We have so far included 10 patients with T1-T2 N0 M0 squamous cell carcinoma of the tongue referred to PORT. Nine patients were treated with 50 Gy in 2 Gy fractions, and one patients with 60 Gy in 2 Gy fractions with concurrent chemotherapy (cisplatinum) because of positive surgical margins. All patients underwent daily kV cone-beam CT (CBCT). From each CBCT we obtained three distance measures from the sagittal images: The caudo-cranial air gap from the cranial border of the tongue to the palate on the 1) lateral left, 2) midline and 3) lateral right side.

Results: Two of 10 patients had air gaps between the tongue and palate systematically present over the treatment period (Figure, mean air gaps 6 mm and 8 mm) indicating that a caudo-cranial reduction of the CTV for these individuals could be safe. However, for the remaining 8 patients the tongue was mostly located cranially towards the palate. It was not possible to identify a relationship between the size of the air gap and clinical parameters such as resected volume, tumor size, infiltration depth, patient age or gender.