Conclusions: CT imaging allows detection of uterine perforation, as well as sub-serosal insertion of uterine tandem in CT-guided intracavitary HDR brachytherapy for cervix carcinoma. We report a relatively low incidence of these events, even without image guidance during applicators insertion.

EP-1598
An intracavitary/interstitial technique with rotated ovoid-guided needles insertion for asymmetric cervix tumor
N. Amornwichet1, A. Songtong1, M. Kaewsumur1, C. Khorprasert1
1Chulalongkorn University, Radiation Oncology, Bangkok, Thailand

Purpose/Objective: In brachytherapy, cervical tumors with large width and laterally asymmetrical geometry are difficult to treat with intracavitary applicators only. Combined intracavitary/interstitial applicators can optimize the possible dose distributions. This work proposes the use of a commercial available applicator in a modified way for better tumor coverage.

Materials and Methods: A 70-year-old patient with stage IIB cervical cancer was treated with 50.4 Gy in 28 fractions external beam whole pelvic radiotherapy, additional brachytherapy with a planning aim of HR CTV D90 > 90 Gy EQD2 and HR CTV D98 > 80 Gy EQD2 in 4 fractions. An ovoid with holes drilled for guiding needle insertion was used (Utrecht applicator, Elekta Brachytherapy). The first insertion was done by conventional ovoids/needles position. In the second insertion, one ovoid was rotated, not fixed to the tandem and fixation mechanics, the needles were inserted more laterally to improve tumor coverage.

Results: In MRI, the HR CTV maximum width was 4.1 cm, 3.5 cm right-sided and 0.6 cm left-sided from the tandem. HR CTV volume was 49 cm³. With the rotating ovoid technique, the position of needles at level of tumor maximum width was 0.5 cm shifted to right lateral side. And these resulted an improvement of D90 dose from 7.1 to 7.7 Gy and D98 dose from 5.8 to 6.3 Gy while decreasing doses to bladder and sigmoid.

Conclusions: The novel technique of rotating ovoid-guided needles insertion was feasible and resulted improvement of dose coverage to tumor with remarkably laterally asymmetric geometry, and additionally diminish doses to surrounding normal organs.

EP-1599
Uterine perforation during three-dimensional image guided brachytherapy in cervical cancer ñ 3-year experience
C. Ferreira1, A. Alzamora1, A. Pinho2, S. Pinto2, T. Viterbo2, A. Pereira2, L. Carvalho1, L. Salgado1
1Instituto Português de Oncologia do Porto, Radiotherapy, Porto, Portugal
2Instituto Português de Oncologia do Porto, Medical Physics, Porto, Portugal

Purpose/Objective: Cervical cancer is third most common female cancer and the fourth most common cause of cancer death. Combination of external beam radiation therapy (EBRT) with concomitant chemotherapy (CT) and brachytherapy (BT) is an essential treatment modality for this pathology. In intracavitary (IC) BT, an applicator is placed in uterine cavity and vaginal fornices. The accurate positioning of the IC applicator is of extreme importance for delivering the appropriate dose to the target volume, while keeping the surrounding tissues and organs with doses below their tolerance limits. Uterine perforation can lead to under dosage of the target volume and excessive dosage in the organs at risk, compromising local control of the disease and increasing the risk of acute and long-term complications.

The aim of this work is to determine the incidence and characteristics of uterine perforation since the introduction of the 3D image-guided BT and its impact on the treatment of patients with cervical cancer.

Materials and Methods: It was performed a retrospective analysis of clinical and radiological process of patients with cervical cancer treated with utero-vaginal image guided BT, between October/2011 and October/2014.

Results: Between October/2011 and October/2014, 163 patients underwent utero-vaginal BT with curative intent, 314 applications were made. In all patients the treatment plan included EBRT (40 to 50 Gy) with concomitant CT. Uterine perforation occurred in 23 patients (14.1%) and in 27 applications (8.6%). The most common site of perforation was the uterine fundus, followed by the anterior and posterior wall. All patients were treated conservatively without complications. The treatment was feasible in 13 patients who had uterine perforation. In patients who suffered uterine perforation, the average diagnosis age was 55 years old (30 to 74 years old) and the average size of the cervix at diagnosis was 5 cm (3 to 7 cm). Six of these patients were submitted to previous cone biopsy and only 5 patients had retroflexed uterus.
Conclusions: 3D image-guided BT allows accurate identification of uterine perforations, preventing potential acute and long term complications, while ensuring that the appropriated dose is delivered to the target volume.

EP-1600
Dosimetric study for cervical cancer brachytherapy comparing IGBT v.s. prescribing to Point A
M. Zahra1, W. Keough1
1Western General Hospital Edinburgh Cancer Centre, Edinburgh Cancer Centre, Edinburgh, United Kingdom

Purpose/Objective: Compare the dosimetry for plans generated by using the GEC – ESTRO guidelines with a traditional point A prescription in terms of tumour coverage and dose to the OARs.

Materials and Methods: The plans of 30 patients with cervical cancer were reviewed, they all received EBRT to 45 Gy in 25 fractions with concurrent cisplatin chemotherapy. They had 3 CT guided individualised fractions of HDR brachytherapy aiming for a d90 >80 Gy whilst respecting the published OARs dose constraints. These were compared with plans generated using the 3 CT plans for each patient to deliver a prescription of 7 Gy to point A. The plans were compared in terms of the d90 to the HRCTV, v100 receiving 7 Gy/ fraction, and the 2 cc doses to bladder, rectum, sigmoid, small bowel and GI total. We also compared the d90 per cm3 Gy/ fraction, and the 2cc doses to bladder, rectum, sigmoid, small bowel and GI total. We also compared the d90per cm3 Gy/ fraction, and the 2cc doses to bladder, rectum, sigmoid, small bowel and GI total.

Results: A total of 90 individualised plans were compared with 90 plans using point A prescription. The median HRCTV volume was 30.7 cm3 (20.1 – 72.4 cm3), the total combined volume was 34.5 cm3 (20.1 – 72.4 cm3), and the 2 cc doses to bladder, rectum, sigmoid, small bowel and GI total. The paired t-test (T) and Pearson correlation coefficient (r) were used with tailed significance testing level of 0.05.

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Table 1: Individualised plans vs. Point A dosing

<table>
<thead>
<tr>
<th>HRCTV (cm3)</th>
<th>Median (range)</th>
<th>Point A prescribing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01 (0.000001)</td>
<td>1.35 (0.11-2.93)</td>
<td>1.07 (0.23-2.29)</td>
</tr>
<tr>
<td>0.001</td>
<td>75.6 (74.60)</td>
<td>77.7 (61 – 90)</td>
</tr>
<tr>
<td>v=00 (%)</td>
<td>98.4 (88.99), 93.7 (80.99-94)</td>
<td></td>
</tr>
<tr>
<td>r=7.44</td>
<td>4</td>
<td>19</td>
</tr>
</tbody>
</table>

Conclusions: Individualised treatment planning for each brachytherapy fraction using CT scans allows an increase in the number of patients achieving d90 >80 Gy whilst staying within the OARs dose constraints. Prescribing point A without conforming the dose with image guidance can result in a number of patients receiving clinically significant overdoses to the OARs with most likely serious long term toxicity.

EP-1601
Impact of dose constraints on local control and G4 toxicity in image-guided adaptive brachytherapy for cervix cancer
K. Majercakova1, R. Pötter1, S. Banerjee1, C. Kirisits1, A. Sturdza1, P. Georg1, D. Berger1, N. Nesvcl1, M. Schmid1
1Medical University of Vienna, Radiation Oncology, Vienna, Austria

Purpose/Objective: To assess the impact of dose constraints on the clinical outcome in radiochemotherapy and MRI based image-guided adaptive brachytherapy (IGABT) for cervical cancer.

Materials and Methods: Our study population consists of 225 consecutive cervical cancer patients (FIGO stages IB - IVA) treated between 1998 - 2008 by external beam radiotherapy (EBRT) +/- chemotherapy and IGABT. For this retrospective study patients were stratified into two treatment groups: Group 1 (optimal treatment): all dose constraints fulfilled. Group 2 (suboptimal treatment): one or more dose constraints not fulfilled. The following dose constraints (EBRT + brachytherapy dose) were applied: CTV (D90) >85 Gy, Dmax rectum < 70 Gy, Dmax bladder <90 Gy. All doses were calculated by summation of the dose of all EBRT and brachytherapy fractions using the EQD2 model (α/β=10 Gy for target volume and α/β=3 Gy for OARs). Differences in event free interval [local tumor control and grade 4 toxicity (surgery necessary) according to LENT-SOMA score] were compared between the two treatment groups.

Results: Optimal treatment received 77 (34%) and suboptimal 148 (66%) of the patients. The mean follow-up in group 1 and group 2 was 54 and 49 months, respectively. FIGO stage in group 1 versus group 2 was: stage I 14 (18%) vs. 11 (7%), p=0.015, stage II 49 (64%) vs. 88 (60%), p=0.545, stage III 14 (18%) vs. 39 (26%), p=0.172 and stage IV 0 (0%) vs. 10 (7%), p=0.020. There was a significant difference in the volume of HRCTV between the two groups (Group 1 vs. group 2: 34.2 cm3 vs. 47.8 cm3, p<0.001).

Five-year local recurrence free interval was 92.8% in group 1 and 90.8% in group 2 (p=0.028). Grade 4 rectal toxicity was observed in 2 cases in group 1 and 1 case in group 2. Grade 4 bladder toxicity was observed in 0 cases in group 1 and 2 cases in group 2. Five-year event free interval (local recurrence or G4 toxicity) in group 1 and 2 was 90.5% and 79% respectively (p=0.056).

There was a statistically significant difference in the d90 doses achieved by individualised planning compared to prescribing to point A, also only 4 (13%) cases using IGBT failed to achieve a dose of >80 Gy compared to 19 cases (63%). Although the median doses to the OARs were higher for individualised plans, this is contrasted by the number of cases who would have received clinically significant doses above the accepted dose constraints when prescribing to point A, where 2 cases would have received doses of 88.4 Gy and 90.9 Gy to the small bowel for a non-individualised plan.

When looking at the impact of the HRCTV volume on the dose delivered to the tumour there was a negative correlation for both techniques. There was a stronger association for point A prescribing (r=-0.87; p<0.0001) compared to individualised planning (r=-0.52; p=0.003). Conforming the dose to the tumour volume and shape appears to mitigate for the negative effect of large HRCTV volumes.

Conclusions: Individualised treatment planning for each brachytherapy fraction using CT scans allows an increase in the number of patients achieving d90 >80 Gy whilst staying within the OARs dose constraints. Prescribing point A without conforming the dose with image guidance can result in a number of patients receiving clinically significant overdoses to the OARs with most likely serious long term toxicity.

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