survival as well as acute and late toxicities were retrospectively analyzed.

Results: Brachytherapy was performed as initially planned in all but one patient. 18 patients had a complete endoscopic response at the first follow-up examination. Loco-regional recurrence was observed in 24 patients after a median time of 3 months; 1- and 2-year recurrence-free survival rates were 51% and 51% for the patients treated for primary tumors and 11% and 6% for patients treated for tumor recurrence, respectively. Median overall survival was 18 months; estimated overall survival rates at 1, 2 and 3 years were 63%, 50% and 30% after primary brachytherapy, and 60&, 25% and 6% after treatment for recurrent cancers. Adenocarcinoma histology, non-complete remission after treatment and treatment for recurrent cancers were associated with significantly reduce prognosis. Mild to moderate dysphagia was the most common side effect in 17 patients; 8 patients suffered from loco-regional grade 3 toxicities, and no grade 4 or 5 toxicities were observed.

Conclusion: Endoluminal brachytherapy during the course of esophageal cancer treatment can be safely applied and results in good functional outcomes regarding dysphagia with moderate local toxicity and low side effects to the lung and heart.

EP-2018

Treatment with high dose rate plesiotherapy and custom moulds in skin cancer. Long term results

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Purpose or Objective: To describe the technique used in our department for treatment of cutaneous tumors with HDR plesiotherapy using custom moulds and to analyze long term results.

Material and Methods:
Custom made mould fabrication:
We used this aplicator in irregular areas of skin.
The treatment sequence is:
- Creation of the mould with thermoplastic material with a thickness of 5 mm.
- Parallel placement of transfer guide tubes with 1 cm of separation.
- CT simulation and definition of the volume treat. The volume has to be delimited 5 mm in deep.
- Dosimetry.
- Treatment of the patient.

We used 3 different schedules:
- 54 Gy in 18 fractions
- 66 Gy in 33 fractions
- 40 Gy in 10 fractions

Results: From September 2008 until September 2015 53 patients had been treated with this technique.
The average age was 77 years (63-91), the histology was squamous in 6 cases, basocellular in 46 cases, melanoma in situ in 1 case.
The mean dose was 54.8 Gy (40-66). The treatment was adjuvant after surgery in 41,5% of the patients.
After a mean time of follow up was 34,1 months there were 2 local relapses (3.77%) in the treatment location. No deaths related to disease were observed.

Conclusion: Treatment with HDR plesiotherapy using custom moulds is a technique used to treat small lesions and/or irregular surface locations. Planning with CT scan allows to know the dose in organs at risk using dose-volume histogram. This treatment offers a high local control of the disease and can be used alone or as adjuvant treatment after surgery in case of positive margins or presence of adverse factors.

EP-2019

The safety and efficacy of external beam radiotherapy combined yttrium 90 SIRT

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Purpose or Objective: Previous literatures showed prior liver external beam radiotherapy (EBRT) may increase liver toxicity after yttrium-90 (90Y) selective internal radiation therapy (SIRT). In contrast, the safety of EBRT followed by SIRT is unclear. We investigated the safety and efficacy of EBRT followed by SIRT in hepatocellular carcinoma (HCC) patients.

Material and Methods: Between October 2011 and May 2015, a total of 11 HCC patients who had treated with SIRT followed by liver salvage EBRT were enrolled. The SIRT 3-dimensional absorbed dose distribution of each patient was retrospectively calculated on a voxel base, using post-treatment bremsstrahlung SPECT/CT images. The physical dose and biological effective dose (BED) of SIRT and EBRT were generated and summed for evaluation. The dose-volume histograms (DVHs) of the EBRT, SIRT, and combined therapy were analyzed. Liver-related toxicities were collected by chart-review and classified as Common Terminology Criteria for Adverse Events version 4.

Results: The median time interval of SIRT and EBRT was 95 days (IQR: 66.5-129.5 days). Eight patients (73%) had undergone EBRT for portal vein thrombosis (PVT) and 6 patients (55%) for residual hepatic tumor. The mean SIRT, EBRT, and combined therapy normal liver BED were 52.1±21.0 Gy, 17.9±6.1 Gy, and 69.5±15.0 Gy, respectively. The summed DVH of each patient is depicted in Figure 1. The image study three months post-irradiation showed primary disease PR in 4 patients (67 %) of patients and thrombosis improved in 6 patients (75%) after EBRT. Two patients had no evidence of disease after combined therapy. The median survival was 359.9 days. Total 3 patient (27 %) had developed ≧grade 2 liver toxicities. Patient who experienced hepatotoxicity had higher summed BED (107.0±7.3 Gy vs 58.9±13.5 Gy; P = 0.02). The univariate analysis of summed DVH showed that the fraction of normal liver exposed to more than 70 Gy (V70) was the strongest predictor of hepatotoxicity (9.4±7.2% vs 29.9±4.4%; P=0.007), as presented in Table 1.
Figure 1: DVH of 11 patients

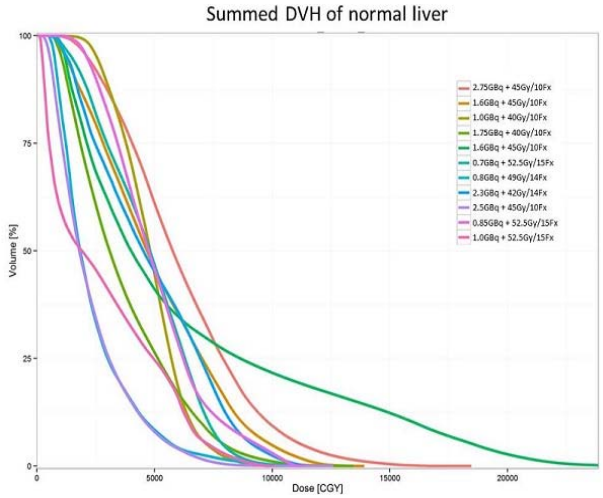

Table 1. Dosimetric parameter univariate analysis

	Hepatotoxicity		
	No (N = 8)	Yes (N = 3)	p value
V10 (%)	89.9 (13.0)	98.7 (0.9)	0.093
V20 (%)	72.1 (20.5)	85.4 (7.8)	0.180
V30 (%)	56.2 (22.7)	72.5 (10.8)	0.184
V40 (%)	42.6 (20.3)	60.5 (11.0)	0.142
V50 (%)	29.7 (15.5)	49.1 (8.6)	0.058
V60 (%)	17.9 (10.8)	39.2 (5.5)	0.007
V70 (%)	9.4 (7.2)	29.9 (4.4)	0.004
V80 (%)	4.8 (4.7)	21.1 (6.2)	0.051
V90 (%)	2.4 (2.8)	14.9 (7.5)	0.137

Values are shown as mean (SD)

Conclusion: Salvage EBRT after SIRT was effective for HCC patients with PVT. The 3D dose summation and BED-DVH of combined therapy help to predict liver toxicity. By carefully selecting patients, the combined therapy bring acceptable toxicities incidence.

EP-2020

Vertical type surface brachytherapy applicator improvement with a 3d printed dose compensation body

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Purpose or Objective: Unflattened surface HDR Brachytherapy applicators commonly suffer from dose fall off on the side of the dose distribution. Recent research documented that in addition to missing dose at the side of the applicator vertical type HDR Brachytherapy surface applicators are subject to underdose in the middle of the treatment region. This artifact is clinically relevant because tumor cells in the middle of the treated area can end up irradiated insufficiently. In this work we present a surface-dose compensation body generated with a 3D printer that specifically addresses the dose irregularities of a vertical type HDR Brachytherapy surface applicator. In order to overcome the limitation of increased treatment time of applicator flattening for horizontal type applicators we utilize the possibility of using a source position nearer to the surface to generate a flattened dose distribution together with reduced treatment time.

Material and Methods: A 40 mm Varian VariSource GM11010080 applicator was used for the modification (Varian Medical Systems, Inc., Palo Alto, CA, USA). The source position is 1.5 cm from applicator tip. The depth of evaluation is 0.5 cm solid water material. A consumer grade 3D printer "UP! 3D, Beijing TierTime Technology Co. Ltd." was used to print out a negative form with ABS plastic. Lippowitz type low temperature melting metal was used to mold the positive form of the flattening elements. All dose measurements and flatness evaluations were performed with Gafchromic EBT3 film Lot #: 12021402 and the FilmQA software, flatness and symmetry toolbox (both Ashland Speciality Ingredients, Bridgewate, NJ, USA).

Results: The generated compensation element is of toroidal shape, for the standard source position 1.5 cm from appliator tip, has a maximum thickness of 1.5 mm in surface direction. The output of the applicator with flattening element occurred to be 75% of the unflattened one. The diameter of 80% nominal dose area increased from 35.2 mm with the unflattended applicator to 50.2 mm with the flattening element in place. The asymetric central low-dose artefact can be compensated to a clinical acceptable minimum dose. When utilizing the source position 1 cm from tip a prototype filter could bring the width of the 80% dose area to 45.0 mm, above the nominal applicator size, and output to 112 % of an unflattened applicator. The position 0.5 cm from tip is still considered flattable with increased low dose area in out of field tissue due to applicator geometry when quick treatment is of clinical interest. The first soure position on applicator tip is not flattable for clinical use.

Conclusion: The presented prototype of a dose compensation body can remove the dose artefacts of a vertical type HDR Brachytherapy surface applicator including the clinical relevant underdosed central region. With the appropriate flattening body it is now possible to utilize a source position nearer to surface and compensate for dose output loss when using a dose flattening element.

EP-2021

Cosmesis and acute toxicity outcomes in skin lesions treated with High-Dose-Rate Brachytherapy.

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Purpose or Objective: Skin cancer is the most common malignancy in white population. The most prevalent histologies are basal cell carcinoma (BCC) followed by squamous cell carcinoma (SCC). They are locally aggressive lesions that rarely metastasize and their prognosis depends on local control. Due to their localization and superficial nature, cosmetic result of the treatment is of primary importance. High-Dose-Rate brachytherapy (HDR-BT) is a safe and effective treatment option for these carcinomas and for other skin lesions. There are two main techniques for its delivery: interstitial brachytherapy and plesiotherapy.
We have evaluated early local control, acute toxicity and cosmetic outcomes in all patients treated with HDR-BT in our center.

Material and Methods: We assessed 47 patients who had 52 skin lesions. There were 29 SCCs, 14 BCCs, 4 keloid scars, 3 adenocarcinomas,1 lentigo maligna and 1 Merkel cell carcinoma. Median age of treated patients was 78 years (34-93). Data was collected prospectively.All lesions were treated with HDR-BT at our institution between December 2014 and August 2015 by interstitial brachytherapy or plesiotherapy. Average total dose delivered was 35,63 Gy and Median dose delivered was 40,5 Gy.
Acute toxicity was graded using the Common Terminology Criteria for Adverse Events, version 4.0 and cosmetic outcomes were classified using the Radiation Therapy Oncology Group cosmetic rating scale.

Results: Average follow-up from completion of treatment was 5.5 months (2-10.1). The overall crude recurrence rate was 3,8% (n = 2). Grade 0 acute toxicity was observed in 7.7% of treated lesions (n = 4), grade 1 in 63.5% (n = 33), grade 2 in 21.2% (n = 11) and grade 3 in 7.7% (n = 4). No acute toxicity greater than grade 3 was observed. All acute toxic events were resolved between the first and the second month after brachytherapy. Cosmetic results were excellent or good in 92.3% of the cases (n = 48), fair in 3.8% (n = 2) and not evaluable in 2 patients whose tumours were not cured.

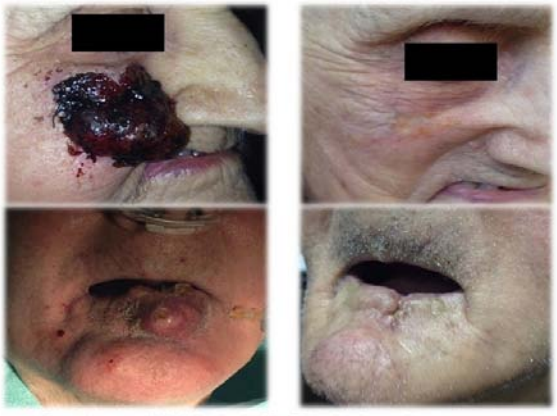

Fig 1. 2 cases of SCC before HDR-BT and 1,5 months post-treatment