PO-0964
High dose-rate interstitial brachytherapy as monotherapy for locally limited mobile tongue cancer
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Purpose or Objective: In order to evaluate the usefulness of high-dose-rate interstitial brachytherapy (HDR-ISBT) as monotherapy for locally limited mobile tongue cancer, we analyzed our clinical experience.

Material and Methods: We investigated 29 locally limited mobile tongue cancer treated by HDR-ISBT as monotherapy at National Hospital Organization Osaka National Hospital between February 2001 and August 2012. The median age of the patients was 60 years (range: 34-84 years). All patients had histologically confirmed squamous cell carcinoma. According to the UICC classification of 2007, 3 T1, 18 T2 and 8 T3 were classified. The median tumor thickness of the patients was 10 mm (range: 2-45 mm). Ten (34%) medically poor risk patients (more than 80 years of age or severe intercurrent disease) were included. One patient had previous irradiation history. All but one patients received 54 Gy in 9 fractions. The other patient reduced his treatment doses (48 Gy in 8 fractions) because of previous irradiation history. We used three-dimensional planning for later 7 patients and delivered the prescribed doses to CTV (clinical target volume). Gross tumor volume (GTV) was defined with metal markers positions, applicator positions, intraoral ultrasonography and CT image. The GTV was equal to the CTV.

Results: The median follow-up time was 47 months (range; 10-171 months). The median V100 (CTV) were 100% prescribed dose (range; 99.6-100%) for 7 evaluable patients. The 4-year local control rates were 100%, 73% and 88% for T1, T2 and T3. The 4-year overall survival rates were 67%, 66% and 31% for T1, T2 and T3. The 4-year control rates were 88%, 83% and 60% for tumor thickness of <10 mm (12 patients), 10-19 mm (12 patients) and ≥20 mm (5 patients). The 4-year overall survival rates were 63%, 67% and 40% for tumor thickness of <10 mm, 10-19 mm and ≥20 mm. Four (14%) patients showed moderate to severe radiation ulcer.

Conclusion: Our treatment result of HDR-ISBT as monotherapy showed good local control result although there were many medically poor risk patients. Overall survival rate was worse for patients who had T3 tumor or tumor thickness of ≥20 mm.

PO-0965
125I seeds implantation under ultrasound guidance for local recurrent tumor of head and neck
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Purpose or Objective: To evaluate the efficacy and safety of interstitial permanent low dose rate 125I seeds implantation under ultrasound guidance for local recurrent tumor of head and neck.

Material and Methods: A total of 70 patients (median age, 60 years; range, 4-94 years) with malignant mass in head and neck were retrospectively studied (from Jan. 2004 to Oct. 2014). 6 were lost to follow-up, and 64 met the inclusion criteria. 81 lesions in head and neck implanted 125I seeds were evaluated. And 54 of 81 lesions were diagnosed cervical lymph node recurrence and another 27 lesions were local recurrence of primary or residual after first management. All the patient underwent 125I seed implantation guided by ultrasonography (Color Doppler Ultrasound with high frequency probe and guiding stabilization devices, Aklokaa-10; Figure 1) with adequate local anesthesia. Postoperative dosimetry was routinely performed by TPS (3D treatment planning system; Beijing Fei Tian Industries, Inc.) for all patients. The actuarial D90 of the implanted 125I seeds ranged from 0.3mCi to 0.8mCi (median: 0.69mCi). The total number of seeds implanted ranged from 3 to 89 (median: 20). The follow-up period ranged from 1 to 103.5 months (median: 14 months). The survival and local control probabilities were calculated by the Kaplan-Meier method (SPSS 16.0).

Results: Among all the 81 lesions, totally response rate was 80.2%, 22 lesions had complete remission CR (27%) and 43 had partial remission PR (53%). The 1-, 3- and 5-year tumor control rates were all 75.2%, 73% and 69.1%, respectively. The results of cervical lymph node recurrence shows better than the recurrence or residue of primary head and neck neoplasm, with the local control of 5 year was 72.7% and 39.9% respectively. As of the date of follow-up, 22 of 64 patients still alive. The 1- and 3-, 5-year overall survival rates were 57.4%, 31%, 26.6% respectively, with a median survival of 20 months. Grade 4 side effects of skin ulceration was seen in 2 patient; grade 1 or 2 skin reactions were seen in 11 patients (17%) who had received external beam radiation therapy before. Other severe complications were not seen.

Conclusion: Interstitial permanent implantation of 125I seeds under ultrasound guidance is feasible, efficacious and safe for refractory head and neck metastasis or recurrence.

Poster: Brachytherapy track: Physics

PO-0966
Dose planning of intraluminal brachytherapy for esophageal cancer using MR imaging
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Purpose or Objective: A new methodology using magnetic resonance (MR) imaging for brachytherapy dose planning of esophageal cancer has been developed. The main objective
have been to determine an MR sequence capable of visualising the tumour and finding a suitable esophageal applicator that can be visualised on the MR images.

**Material and Methods:** A total of six patients were included in this study. Each patient was scanned with one of two T2-weighted sequences, inversion recovery fast spin echo (IR FSE) or fast recovery fast spin echo (FRFSE). To reduce the motion artefacts in the images, the scanning was only triggered when the diaphragm was at the end-exhale position. The imaging was performed on a 3.0 T MR (GE Healthcare). Dose planning on the obtained MR images was performed using two different methods 1) dose was prescribed at 10 mm from the applicator’s centre, which is the method currently used at Skåne University Hospital for treatment based on 2D images 2) dose planning was performed by manual optimisation, i.e., the dwell times were manually adjusted until adequate tumour coverage was reached. To our knowledge, an MR-safe esophageal applicator could not be found at the time of this study. Instead a modified duodenal tube was used. Different contrast agents were studied with the purpose to render the tube’s visibility on the MR images.

**Results:** The esophageal tumour was successfully visualised and delineated on T2-weighted images with the FRFSE sequences, whereas the tumour in the MR images from the IR FSE sequences was difficult to visualise due to poor image quality. Furthermore, improved dose coverage to the tumour was observed when the dose planning was manually optimised to the tumour volume, where V100% to the tumour was increased from 70% to 95% and D90% was increased by 34%. Moreover, the esophageal applicator (duodenal tube) was filled with a saline solution, which was successfully visualised on the MR images.

**Conclusion:** Brachytherapy dose planning for esophageal cancer with MR imaging enhances tumour visibility and the ability to optimise the dose to the tumour volume and organs at risk.

**PO-0967** Current practice in quality assurance of the Papillon50 contact X-ray brachytherapy system in the UK

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**Purpose or Objective:** Papillon50 contact brachytherapy has been used for early rectal cancer treatment in the UK since 1993. Currently there are four centres treating and a few more are in the process of implementation. The National Institute for Health and Care Excellence has issued guidance on safety and efficacy from a clinical perspective. However, there is currently no guidance on quality assurance (QA) testing. This review assessed any significant differences in machine QA practice between the current UK Papillon50 users. This is the first step towards standardising QA tests, tolerances and procedures in order to ensure that the accuracy of this technique is maintained at a high level across the UK.

**Material and Methods:** Each centre provided in-depth information regarding their QA programme. Details on machine-specific design characteristics were also taken into account. An inter-departmental comparison was made with regards to the QA tests performed, the frequency of each test, the accepted accuracy of the results with respect to the set baselines, the setup for each test and the equipment used.

**Results:** Significant differences were seen between centres in the QA tests in terms of types of test, frequency and acceptable accuracy. A tolerance variation of 10% versus 2% in the beam quality check and a difference of 2 mm versus 0.5 mm in the radiation field size check were observed. The manufacturer provides a calibration jig with which all four centres carry out radiation output measurements. However, each centre uses its own HVL jig design. There are significant design differences between these jigs with respect to the source-to-detector distance (SDD), the narrow beam geometry achieved and the backscatter conditions. All centres use the 1996 IPEMB CoP for the determination of absorbed dose for x-rays below 300 kV generating potential and its Addendum (2005) as a reference for the determination of the radiation output. However, the reference conditions stated in the CoP were generally not met due to the inherent design of the calibration jig used.

**Conclusion:** Significant differences exist between centres in the level of accuracy and extent of the QA programme. The very-low energy and short SDD in the Papillon50 system result in a very rapid dose fall-off. Differences in the design of the HVL jig may play an important role in the definition of the beam quality in such conditions. An extension of the CoP Addendum may be needed to include the achievable Papillon50 measurement conditions. This review highlights the need to carry out an independent audit in order to assess whether the inter-departmental variations observed could result in differences in the treatment received by patients.

**PO-0968** Development of a fluorescent screen based QA system for dose verification of afterloading HDR unit

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**Purpose or Objective:** To develop and assess the feasibility of an in-house developed fluorescent screen based system on dose distribution verification of HDR brachytherapy treatment delivery.

**Material and Methods:** The QA system consisted of a solid water block with various thicknesses on top of a fluorescent screen (Kodak, Lanex regular screen) and a PMMA block below the screen. The fluorescent signal light was reflected by a mirror below the transparent PMMA to a CCD camera. The whole system was contained in a light tight box. Dose linearity was examined in a previous experiment. In measurement, an IR-192 source was loaded to an applicator positioned on top of the solid water block. Single source dose distribution without entrance dose effect was first acquired to help obtain a universal light deconvolution kernel. It will then be used in subsequent image processing. Two source dwell positions were placed in each measurement with equal weighting. Source intervals were 5 mm and 10 mm. Four different measurement distances were selected, ranging from 5 mm to 30 mm away from the applicator. Various dwell times ranging from 0.8s to 8s were assigned at different depth to produce the optimal light output. Captured images were then processed by applying a median-filter and the deconvolution kernel to remove radiation induced noise and deconvolute the acquired image, respectively. After the image processing, images were normalized and a region of interest (ROI) (16 cm²) was selected. Gamma index comparisons were performed between acquired dose distributions and the respective depth calculated by TPS (Elekta, Oncentra). Two profiles which cross the central line of the source dwell positions were obtained.

**Results:** The system can obtain a dose distribution with resolution 0.257 mm per pixel. Gamma index comparisons, (3% dose difference/1 mm DTA) were performed on all 8 conditions. Results were tabulated in Table 1.