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Small field Dosimetry with the new generation Exradin W2 scintillator detector

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Prospective/Objective: The aim of this study is to evaluate the new generation of scintillator detector, Exradin W2, for commissioning measurements and routine check in small field dosimetry.

Materials and methods: Percentage dose depth, transverse profile and field output factors were measured in a 6 MV beams for small field sizes ranging between 1x1 cm2 and 5x5 cm2 in a PTW MP3 water phantom with four different detectors: PTW 31016 PinPoint3D, PTW 60023 microSilicon, PTW 60019 microDiamond and Exradin W2 scintillator detector. The parameters analyzed for PDD curves were relative surface dose (DS), depth of dose maximum (Dmax) and of 50% of dose (R50) and percentage dose at 100 mm (D100). In addition, maximum difference in distance (mm) and difference in Percentage Dose (%), within the 20-80% PDD region for all detectors (PinPoint, microSilicon, microDiamond), with respect to the Exradin W2 were evaluated. Penumbra width and field size were derived from transverse profiles both in cross and in-plane profile for each field size with all four detectors and were compared. OFs measurements were performed for each field size by the four detectors at 10-cm depth, 100-cm source–detector distance. The 5 × 5 cm2 field size was used for the normalization of OFs. By adopting the methodology recommended in TRS4831 for small photon beam dosimetry, two orthogonal profiles were subsequently acquired with the smallest field size and each detector was positioned at the maximum detector signal point. The ratio of the readings in the clinical field and in the reference, field was evaluated for each detector. Then, the field output factor, was evaluated by applying the output correction factor for each detector and each effective field size. For the Exradin W2 no correction factors were applied. Relative Deviations between corrected measurements performed by each detector and the Exradin W2 were calculated.

Results: For PDD measurements, an agreement within ±2% was observed among the detector responses for all the field sizes over the whole PDD curve, except for the build up region. Penumbra width derived from in-plane and cross- plane profiles with the four detectors were within 1.5 mm for all field sizes. Field size differences evaluated for the four dosimeters were less than 1mm. For Field Output factors, differences between Exradin W2 and other detectors were less than 0.5% for field sizes larger than 1x1 cm2. For 1x1 cm2 field sizes we found a maximum difference of 2.9% between Exradin W2 and corrected PinPoint Ionization Chamber measurement. The combined uncertainties for the measurements were estimated to be within 1.5% for the all the dosimeters.

Conclusion: The new W2 Exradin detector proved to be a suitable detector for accelerator linear commissioning measurements and routine check in small field dosimetry. The problem related to the first commercial version of this kind of detectors, the Exradin W1, regarding the lack of possibility to perform scanning data measurements has been successfully overcome. The new electrometer MAX SD allows manipulation of baseline values like Cerenkov light ratio and collection of point measurements. In addition, the MAX SD can convert the Cerenkov corrected signal into analog output that can be read by an external single channel electrometer thereby making the W2 detectors useful for scanning dosimetry.

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Novel Techniques of In Vivo Dosimetry in Low kV Intraoperative Radiotherapy

Prospective/Objective: Intraoperative Radio Therapy (IORT) is one of the most attractive radiotherapy techniques now-a-days with several positive sides. During IORT, a very important aspect is in vivo dosimetry. The purpose of this study was to calibrate two types of dosimeters, radiochromic films (RC) and MOSFETs, for in vivo measurements in IORT with low-kV x-rays delivered by Intrabeam system for breast cancer patients. We also wanted to make a comparison of the characteristics between both dosimeters and at the end choose the most suitable one to be used in our centre.

Materials and methods: The Intrabeam system is a miniature kV x-ray source manufactured by Zeiss and is designed especially for IORT applications. The calibration of both EBT-3 RC films and MOSFETs were done with Intrabeam which is the 50 kV source. EBT-3 films were calibrated using the red and green channels of the absorption spectrum in the 0–15 Gy dose range delivered by the low kV source. We also checked the effect of different self development time and orientation of scanning of EBT-3 films. The calibration of MOSFET was done for the same dose values. We used the calibrated films for in-vivo dosimetry during IORT of breasts for doing an independent QC of the treatment by placing one piece of RC film wrapped in sterile envelope on the skin of the patient after breast conserving surgery.

Results: We found from EBT-3 calibration that, in the low dose range the red channel shows better sensitivity, while starting from 5 Gy the green channel has better sensitivity. Then we built the calibration curve of RC film for both channels & these curves were used to measure skin dose during IORT. Moreover, dose to an implantable cardiac device was measured using films. Results from MOSFET calibration showed linear response in the dose range of interest. Results from in vivo measurements performed with RC films showed that, the technique is completely safe from side effects to the skin. The value of skin dose to each of the patient was within the threshold which is 5 Gy.

Conclusion: We were able to complete the task with clinical evidence which showed an excellent result for the RC films. In conclusion we can say that, IVD with EBT-3 films is a feasible procedure. Measured dose to the skin indicates that the technique is safe from side effects to the skin. As we calibrated MOSFETs also, we found that, MOSFET is also a strong dosimetry tool which can be used for IVD to the OAR such as skin.

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Geometric and Dosimetric Validation of An Artificial Intelligence Based Auto-Contouring System for Radiation Therapy Treatment Planning: A Clinical Feasibility Study.

Prospective/Objective: Geometric metrics are often used to evaluate automated contouring methods. A dosimetric parameter analysis may be more useful in clinical practice, although it is frequently absent in the literature. The purpose of this study was to look into the effect of state-of-the-art AI-generated anatomical delineations on dose optimization in radiation therapy (RT) for patients with prostate, breast, and H&N cancer.

Materials and methods: The auto-contouring system was evaluated using a database of 60 computed tomography images comprising prostate, breast, and H&N structures. Clinically accepted reference plans are directly copied for dose calculation of auto contoured structure sets. Dice similarity coefficient (DSC), Hausdorff distance (HD) and Relative Volume Difference (RVD) were used to assess geometric performance of contours. Dmax, Dmean, and D0.03cc indices were used to analyze OAR dose distributions with manual segmentation as a reference. For measuring overall plan acceptability, normalized plan quality metrics were evaluated. A Wilcoxon rank sum test was computed between dosimetric metrics. Inter-observer variability was also assessed for prostate cancer site.

Results: AI-based segmentation saved more than 57% contouring time and achieved an average DSC of 0.80 for prostate, 0.90 for breast and 0.75 for H&N with a few exceptions and the average HD (& RVD) were below 13mm (0.20), 25 mm (0.22) and 11mm (0.25), respectively. The dose parameters, Dmax, Dmean and D0.03cc for the prostate, breast and H&N patients, showed agreement between dose distributions within ±8%, ±5% and ±3%, respectively. In all situations, the difference in plan quality was less than 8%. The dose parameters changed slightly due to inter-observer variability. The comparison between geometric and dosimetric metrics showed no strong statistically significant correlation without a few exceptions.

Conclusion: Although auto-contouring system achieved state-of-the-art geometrical performance, human review is still unavoidable. Plans, based on auto-contouring, do not overdose nearby OARs. The auto-contouring system is recommended as a standard starting point with institutional geometric and dosimetric validation.

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Characterization of a solid-state detector gamma camera dedicated to nuclear cardiology

Prospective/Objective: This study aims to characterize the solid-state detectors gamma camera DSPECT (Spectrum Dynamics Medical, Caesarea, Israel) by analyzing the quality of myocardial SPECT images through different figures of merit (spatial resolution, uniformity of perfusion, and contrast) over a wide range of counts statistics (1, 0.8, 0.6, 0.4, and 0.25 million counts) in the Left Ventricle (LV) wall while using an anthropomorphic phantom mimicking normal and pathologic LV perfusion conditions.

Materials and methods: The experimental part of the study was done in two sessions. Both sessions used an anthropomorphic phantom of the chest (Torso phantomTM and Cardiac InsertTM, Data Spectrum Corporation, Hillsborough, NC, USA) with lungs, liver, and dorsal spine insert included. Lung's insert is filled with Styrofoam beads and non-radioactive water to mimic the density of lung tissue attenuation. The first session consisted of the preparation of the anthropomorphic phantom by inserting a cold defect in the left ventricle (LV) wall simulating a transmural defect (TD) and the second one by mimicking a normal LV, i.e., without any cold insert. For the two preparations, the acquisition was made at different count statistics in the LV wall image area (1,0.8,0.6,0.4,0.25 million counts). Pathological phantom acquisitions were made twice for each count statistic and for each position (Ant, Lat, Post, and Sept) of the cold defect. The normal phantom was re-positioned three times and for each position, two acquisitions were performed for each level of count statistics. The quality of the reconstructed images was evaluated in terms of contrast of the internal cavity (C_IC), the thickness of the LV wall, and the sharpness index (SI). On the polar maps reconstructed from the short axis slices of the LV phantom, other parameters have been evaluated, including uniformity of segmental uptake for the uniform phantom and TD contrast and variation in the segmental uptake for the pathologic phantom.

Results: All the Images quality parameters (Thickness of the LV wall, Sharpness index, Contrast of the internal cavity, Uniformity of segmental uptake, contrast of the TD, and variation of the segmental uptake) showed no difference when moving from the reference level counts statistics (1 Mc) down to 0.25 Mc in the Left Ventricle wall. The segmental uptake of the uniform phantom showed a decrease in the perfusion in correspondence with the mid-basal infero-septal position, as already evidenced by the literature. Moreover, the TD contrast was significantly lower for the defect placed in the posterior wall, with respect to the other positions.

Conclusion: Our results demonstrate that in clinical circumstances and using the reconstruction parameters currently advised for the clinical routine there are no differences in the considered parameters along the range of counts statistics explored. This result allows to administer a lower activity to the patient or use reduced scan time, to enhance patient comfort and limit the radiation exposure of both patients and operators.

Partial Volume Effect (PVE) correction in Single Photon Emission Computed Tomography (SPECT) imaging

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Prospective/Objective: The purpose of this work was to implement a home-made post-reconstruction algorithm to correct the PVE in the SPECT image to improve its quality for better quantification in diagnosis and therapy

Materials and methods: The NEMA IEC phantom inserts the six spheres of different sizes to study the PVE of two activity concentration measurements of 4.6 and 12.19 mCi/L of 99mTc respectively filled with a 10:1 signal-to- background ratio. The scan was performed on the Discovery NMCT 670 GE using clinical protocol. The images were reconstructed by OSEM 2 iterations, 10 subsets, Butterworth filter 0.48, CT based attenuation and scatter correction was used. In addition, the non-filter image was studied. The system PSF was performed with the same protocol. Two methods were used to correct PVE. First, the post-reconstruction algorithm based on the mathematical theory implemented in MATLAB, was used to correct the PVE in SPECT images studied and the second method is the recovery coefficient (RC). The raw and corrected image quality of the IEC phantom has been studied in terms of RC and contrast. In clinical application, 10 Hepatocarcinoma patients treated with Yttrium 90 were studied. All data has been analyzed with MATLAB, image J, LIFE x v7.3.0 and Xeleris software.

Results: Results showed that at 4.6 mCi/L, a ratio of 10.26 was obtained for the filtered image only for the large sphere, while all other spheres, except the smallest of the non-filtered corrected image, achieved a ratio greater than 10. The mean recovery values measured at 12.19 mCi/L for the small spheres in the filtered image, were 38.18 % versus 0.8 % for the post-reconstruction method and the classical RC method respectively. PVE recovery in small spheres is more accurate for post reconstruction method. The mean recovery values for all spheres size, obtained by the post-reconstruction method for the filtered image were 45.16 % versus 47.45 % measured at 4.6 and 12.19 mCi/L respectively and for the non-filtered image 42.53 % versus 47.3 % measured at 4.6 and 12.19 mCi/L respectively. For the classical RC method, both image types gave 12.88 % versus 10.13 % measured at 4.6 and 12.19 mCi/L respectively. The quality of the image studied in terms of contrast showed that it increases as the size of the sphere increases. Clinical images of HCC patients treated with 90Y microspheres were corrected for PVE. A significative improvement in contrast was demonstrated after this correction.

Conclusion: The post reconstruction method has proven more effective for clinical use. It is based on the mathematical theory of deconvolution to correct the PVE and depends on the sigma PSF system for its configuration. This is not an ideal tool as it is also limited by the scanning procedure such as phantom filling or patient injection and system spatial resolution.

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aCom**missioning and clinical implementation of the 1600 SRS Octavius detector**

Prospective/Objective: To commission a new device for pre-treatment patient specific verification of stereotactic treatments plans, which is capable of reconstructing 3D dose with high resolution (Octavius 1600SRS)

Materials and methods: Octavius 4D system (PTW) consists of an ion chamber array embedded in a cylindrical phantom which, assisted by an inclinometer, rotates synchronously with the gantry. It measures planar dose distributions as a function of gantry angle in order to compute the resulting 3D dose distribution. There are diverse options for the ion chamber array, we used the new Octavius 1600 SRS (small field size, high resolution). We have used one TrueBeam linac STx with MLC HD 120, the TPS has been Eclipse (v.15.5) and analysis have been performed with Verisoft (v.8.1). The commissioning measurements consisted of the following tests: (1) matrix calibration factors variation with dose rate and field size; (2) Dose rate dependence; (3) Field size dependence; (4) influence of geometry on PSQA results; (5) verification and analysis of typical SRS and SBRT plans, comparing TPS-calculated versus measured dose.

Results: We found the following results for Octavius 1600 SRS): (1) The matrix calibration factors has shown a maximal variations of 2.80% and 4.10%, respectively for 6FFF and 10FFF beams, within the range of filed sizes and dose rates considered. (2) For dose rate dependence a maximal variations of 1.702% and 1.853% was recorded for 6FFF and 10FFF beams. (3) For what concern field size dependence a maximal variations, obtained at the smallest field of 1.498 % and 3.355% for 6FFF and 10 FFF beams was recorded with an energy dependence of 1.857%. (4) It has been shown that dose agreements can deteriorates when the main lesion is shifted from the center of the phantom and when PSQA are delivered in non-isocentric conditions. (5) Verification of SRS and SBRT plans showed that the 2%, 2 mm, cut-off 10% and mean local dose difference criterion could help to replicate the former PSQA outcome.

Conclusion: Octavius 4D system together with Octavius 1600 SRS is an adequate tool for patient specific QA of treatments requiring high spatial resolution, but the dependence of its response with field size and dose rate can hinder its clinical adoption if not properly tamed. The collected set of measurements suggests that PSQA results obtained with Octavius can approach those performed with IC or ArcCHECK if the following criteria are used for the analysis: -local 2%/2mm gamma with a cut-off of 10% of the dose and an action level of 95%; mean local dose difference with dose cut-off at 70% (to check the high dose regions) with an action level of 4%.

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3D printed lung phantom design and applications in evaluating lung SBRT respiratory gating treatments with surface guided radiotherapy for positioning

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Prospective/Objective: This study aims to develop a 3D printed lung phantom as an add-on to the QUASAR™ respiratory motion phantom and use it to evaluate lung SBRT respiratory gating treatments and testing surface guided radiotherapy for positioning. In particular TPS dose calculation accuracy on two different scans was tested against Gafchromic film measurement on a gated treatment.

Materials and methods: We evaluated the median diameter and volume of PTVs (spherical equivalent) for lung-SBRT using Eclipse (Varian Medical Systems) version 15.5 treatment planning system (TPS), taken from 41 patients who underwent lung SBRT with free breathing and 36 patients who underwent DIBH treatment. In total, 42 Lung SBRT PTVs have been selected based on 3-8 fractions of the lung SBRT treatment since 2021. The average planning volume (PTV diameter) was used to produce lung phantom using 3D printer technology. A patient-specific 3D-printed lung phantom was fabricated by using a 3-D printer (Original Prusa i3 MK3S+ 3D printer, Josef Prusa). Based on the QUASAR™ respiratory motion phantom geometry the phantom was printed with 8 cm diameter, 15 cm length. Besides the target is centered to the middle of the fabricated phantom with a mass density of 1.2 g/cm3 and Hounsfield Unit value of 68 HU. The surrounding tumor tissue is infill by PLA composite with a 30% infill density and -655 HU of surrounding tissue. The phantoms were splitted into half in order to measure 2-D dose delivery by inserting Gafchromic film dosimetry. Based 4-D CT construction ITV was delineated on 30%-70% of breathing phases. VMAT planning was used for treatment and selected 30%-70% of the breathing cycle as the gating window. As an application of the 3D printed lung phantom, the TPS plan was optimized with Base 30-70 % 10X-FFF and re-calculated with Av-IP (30-70%) 10X-FFF and finally compared with Gafchromic ETB-3 film measured dose.

Results: The measured passing rates of gamma analysis seen to over all 3%/3 mm, 3%/2 mm and 2%/2 criteria, (97,95 and 93 %), (95.6, 92.9 and 91.1 %) and (100,100 and 99.9 %) similar results between Gafchromic ETB-3 Vs Base 30-70 % 10X-FFF, Gafchromic ETB-3 Vs Av-IP: 30-70% 10X-FFF and Av-IP: 30-70% 10X-FFF Vs Base 30-70 % 10X-FFF respectively

Conclusion: It was found that the Dosimetry verification results were extremely similar for both calculated-TPS plan Vs Gafchromic ETB-3 film systems.

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Commissioning of Elekta Unity MR-Linac and beam validation of Monaco Treatment planning System model: A single institution experience

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Prospective/Objective: The purpose of this study was the commissioning of the Elekta unity MR-Linac installed at ASST Spedali Civili, Brescia and beam validation of Monaco treatment planning system model.

Materials and methods: Dosimetry measurements and Mechanical tests were performed on an MR-Linac using a different detectors. Dosimetry measurement consisted of comparison between measured and calculated PDDs and profiles, measuring beam quality, reference dosimetry and correlation between CT numbers Vs RED curve. Mechanical test included: MLC transmission, measurement of radiation isocentre diameter, Gantry angle accuracy and MR to MV Coincidence. Measurement devices included Semi flex 3D (PTW 31021), microdiamond (PTW 60019), and Farmer-type (PTW 30013) detectors in an Elekta PTW MP1 water phantom. PTW MP1 scanning water phantom was used to measure depth dose curves and profiles for various depths and for field sizes between 1 x 1 cm2 and 57 x 22 cm2 for an Elekta MR-linac beam with the perpendicular 1.5 T magnetic field. Gammex phantom was also used to correlate CT numbers Vs RED curve in the treatment planning system.

Results: Gantry angle accuracy was within < 0.3 °, the measured radiation isocentre was < 0.5 mm and the coincidence between MR and MV isocentre was -0.14(x), -0.61 (y) and -1.36 (z) mm which is accounted for in the treatment planning system (TPS). The TPR20, 10 was measured, as it is an adequate beam quality specifier for the MR-Linac beam. Gamma analysis is used to assess the agreement between calculation and measurement of dose distribution. Excellent agreements were obtained between calculated and measured dose distribution interims of percentage gamma passing rate criteria. The average gamma passing rate was 98% for profiles and 100% for PDD curves, considering 2% dose difference and 2mm distance to agreement as acceptance criteria. When we used 2 mm distance-to-agreement and 1% dose difference, the agreement between the TPS model and measured scan data showed a satisfactory level of agreement. 30.9% of profiles completely pass the chosen criteria, the analysis of remaining 69% of the profiles demonstrates that measurement error becomes a limiting factor in achieving a better score and 85.7% PDDs curves pass the chosen criteria.

Conclusion: As a result, Commissioning of Elekta Unity MR-Linac and beam validation of the Monaco treatment planning system model for the first time at AAST Spedali Civlili of Brescia is suitable for clinical use.

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Implementation of quality assurance for a High Dose Rate brachytherapy system in the clinical environment

Prospective/Objective: This work focuses on the overall quality assurance of HDR brachytherapy system during: acceptance of the afterloader, source exchange and treatment, including HDR brachytherapy source strength determination and implementation of those quality assurance in the clinical environment.

Materials and methods: Safety quality control testing of HDR brachytherapy system were performed within and around the treatment room. Some selected frequency and tolerances of these safety and physical checks have been assessed. Five measurements were performed in order to ensure the accuracy of source dwell position by source position check ruler and the results were analyzed by imageJ software. To determine linearity of the timer, we collected charges on the electrometer at a fixed measurement position with varying dwell times, for 5, 10, 20, 40 and 80 seconds, the measurements were described graphically by plotting the reading versus dwell time graph. A sheet of Gafchromic film was used for assessment of the offset of some gynecological applicators. To determine the maximum sensitive point of the well-type ionization chamber, the source was moved from top of well chamber with a step size of 1 mm inside the source holder and a set of three measurements for each of the 21 selected dwell positions was taken. The reading (in nA) were tabulated and scattering contribution was assessed by placing the chamber in different scattering effect environment. Reference air kerma rate was determined by sending the source out to maximum sensitive position of the chamber and measurement value was compared with the expected value. During source exchange, a contamination test was also performed by wipe test. Finally, the relevant QA values are used within the treatment planning system.

Results: We found that the nominal and the measured source positions were accurately matched with a difference of less than 1 mm. Offset of applicators obtained in this work is the same with the values given by the vendor, with less than a half millimeter difference. Correlation between programmed times and acquired charges showed good linearity and the measurement was reproducible. The percentage of difference between reference air kerma rate measured with electrometer timer and machine timer is 0.1 % and 0.2 % which indicates the timer is accurate. Both measured values have 0.9% and 1.3% difference from the expected values, within 3% of tolerance in the determination of reference air kerma rate.

Conclusion: The results shows that the source is positioned accurately at expected dwell position. The offset for all the considered gynecological applicators matches the value given by the vendor, that is used in TPS. The timer has a good linearity and is also accurate. All other tests passed and were within acceptable tolerance levels. The performance of all these tests guarantees a proper and safe delivery of the radiation dose.

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Dosimetric Study of Fetal Dose during External Beam Radiotherapy using OSLD

Prospective/Objective: In the Nuclear Medicine department of the Spedali Civili di Brescia, therapy with Lutathera has been performed on 31 patients in the period between November 2019 and October 2022. Patients are released from hospital when their radiation exposure is below established radioprotection levels. The recommendations given to the patient are based on the principle that the radiation dose to people should be kept as low as reasonably achievable. The aim of this study is to evaluate if there is a correlation between the location of the different lesions of the patients and the exposure rate at 1 m.

Materials and methods: The recommended treatment regimen with Lutathera consists of four separate infusions of 7400 MBq each one. The Lutathera protocol requires SPECT-CT images taken at 24, 48 and 120 hours after the administration, always on the same gamma camera. The equipment used was Discovery 670 GE SPECT-CT system. The image correction is done using the algorithm IRACSC (iterative reconstruction attenuation and scatter correction and MIP (maximum intensity projection). For release the patient, dose rate measurements are taken at 1 m and 30 cm from the front of the mid-abdomen of the patients using a Geiger counter. Usually, when the average dose rate at 1 m is less than 5 µSv/h, the patient is released from hospital. The internal dosimetry of OAR (organ at risk) and tumor lesions was performed with the MIRD (Medical Internal Radiation Dosimetry) average dose method, using the ImageJ, Pet-Ct Viewer and homemade plugins and the radiation dose assessment software OLINDA/EXM.

Results: It was found that there is a weak positive correlation between exposure rate at 1 m and anatomical localization of lesion when lesions are in the abdomen, a moderate positive correlation for lesions in the pelvis and a strong positive correlation with lesions present in the other regions (head, arms, and legs). While there is no correlation with the lesions located in thorax and column. Regarding the patient's response to therapy, according to the RECIST criteria, 88.89% of the patients present a stable disease, while 11.11% of the patients have a partial response. The average volume diminution of the lesions 17%. The mean dose to lesions was 89.25 Gy (min = 0.42 Gy, max = 905.56 Gy) and the mean dose to kidney was 3.62 Gy (min = 1.30 Gy, max = 4.73 Gy).

Conclusion: RPT with Lutathera results as a valid therapy, with a stable disease response to the therapy which is favorable for patients with an advanced state of cancer. On the other side, the anatomical localization of the lesions is not correlated with the exposure rate measured using external radiation detector.

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Multicentre intercomparison of semi-quantification in neuro-imaging

Prospective/Objective: Brain imaging with DaTSCAN (Ioflupane I-123) is used to detect loss of functional dopaminergic neuron terminals in the striatum of patients with clinically uncertain parkinsonian syndromes. The uptake of this striatum is semi-quantitatively evaluated with VOI techniques. In this work, a standardization procedure of the acquisition and processing of DaTSCAN imaging between the different centers member of the Italian Neuroscience and Rehabilitation Network (Rete Italiana delle Neuroscienze edella Riabilitazione, RIN) was performed.

Materials and methods: The free software BasGanv2 was employed to assess the specific binding ratio (SBR) in the striatal sub-structures: caudate nucleus and putamen. This parameter was used to compute the recovery coefficient (RC), defined as the ratio of the true and the measured SBRs. Data were collected from 9 centers: 3 of them with SIEMENS and 6 with GE SPECT systems. In each center, images of a Striatal Phantom (with 4 different striatal to background ratios) were acquired following standard protocols. Two methods of tomographic reconstructions were studied: Filtered Back-Projection (FBP) and Ordered-Subsets Expectation-Maximization (OSEM). Analysis on the application of attenuation correction (AC) with the use of LEHR collimators was also performed with the acquisition of images of a cylindrical phantom.

Results: Differences in the processing software of these two vendors (SIEMENS and GE) were found. An optimization of the reconstruction parameters was performed for both systems: FBP with Butterworth filter with 0.45 Nyquist and order 10 for SIEMENS and its equivalent 0.68 cycles/cm and power 20 for GE; OSEM with 10 iterations and 10 sub-sets, using a Gaussian filter of 5 mm for SIEMENS and 1.42 pixel for GE. For both methods, attenuation correction and scatter correction were not applied. The results showed that, when using OSEM reconstruction, the RCs obtained for the SIEMENS SPECT systems are slightly higher than those obtained with the GE SPECT systems. When using FBP, the BasGanv2 software showed limitations in the image processing. Therefore, further investigations have to be carried out.

Conclusion: The presented standardization procedure was demonstrated to obtain comparable results between these RIN centers. o obtain comparable results between these RIN centers.