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## PREDICTIVE ROLE OF FDG PET/CT IN HEAD AND NECK CANCER TREATED WITH RADIOTHERAPY — PRELIMINARY RESULTS

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## T2-3

**The Impact of the Q.Clear Reconstruction Algorithm on the Quantitative Evaluation of Hepatic Metastases Shown on 18F-FDG-PET/CT Studies — Preliminary Results**

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**INTRODUCTION:** PET/CT scans are routinely reconstructed by iterative algorithms, where a well-known limitation is the worsening of the signal-to-noise ratio when increasing the number of iterations. A novel Bayesian penalized likelihood reconstruction algorithm (Q.Clear) has allowed more iterations without simultaneously significantly increasing noise levels that results in a better signal-to-background ratio. The aim of our study was to compare this algorithm with the conventional OSEM reconstruction by investigating 18F-FDG-PET/CT studies.

**METHODS:** We investigated the 18F-FDG-PET/CT studies of 9 patients (8 women, 1 man) and a total of 24 FDG-avid hepatic metastases were included in our sample. The raw data of each patient were reconstructed by both the OSEM and the Q.Clear algorithm. A spherical VOI of 8 mm diameter was placed in the normal hepatic tissue as reference and a spherical VOI was manually adjusted to the metastases, both in an identical location in the two differently reconstructed studies of each patient. The size of the lesions were calculated by the largest axial diameter measured on the CT scans. Standardized uptake values (SUV) based on body weight were calculated, including SUVmax and SUVmean. Noise was defined as the standard deviation of the normal liver parenchyma SUV. Signal-to-noise ratio was given as SUVmean in the normal liver parenchyma divided by the noise. Signal-to-background ratio was defined by SUVmax in a lesion divided by the SUVmean in the normal liver parenchyma. Two-tailed paired sample t-tests were calculated to compare the datasets.

**RESULTS:** The average size of the lesions was  $18 \pm 8.85$  mm (range: 10–53 mm). The Q.Clear algorithm resulted in significantly higher SUVmax and SUVmean values in the lesions ( $p < 0.001$ ).  $\Delta$ SUVmax  $2.12 \pm 1.75$ ,  $\Delta$ SUVmean  $0.50 \pm 0.48$ . The signal-to-background ratio was significantly better with Q.Clear ( $3.93 \pm 2.45$  vs.  $2.87 \pm 2.26$ ;  $p < 0.001$ ) while signal-to-noise and SUVmean-to-noise ratios were not significantly different. The latter can be explained with the (non)significantly higher levels of noise by using Q.Clear.

**CONCLUSION:** Our study showed that the Q.Clear reconstruction algorithm resulted in better signal-to-background ratios without the decrease of the signal-to-noise ratio in FDG-avid hepatic metastases which leads to better recognition and characterization of the lesions.

## T3. ONCOLOGY — PET

## T3-1

**INCIDENTAL LESIONS IN FDG-PET/CT SCANS**Gábor Sipka<sup>1</sup>, Zsuzsanna Besenyi<sup>2</sup>, Zsolt Lengyel<sup>3</sup>, László Pávics<sup>4</sup><sup>1</sup>Department of Nuclear Medicine, University of Szeged<sup>2</sup>Positron Diagnostika Ltd., Budapest

**INTRODUCTION:** The modern oncological diagnostics are unimaginable without FDG-PET/CT. During the metabolic information gaining process we often discover different, incidental lesions, which aren't connected to the primary tumours. Our goal in the study was to retrospectively specify the origins of these freshly discovered, independent FDG-avid lesions in „routine” FDG PET/CT scans.

**METHODS:** We revised 828 FDG-PET/CT exams' results, which are asked by the most different oncologic indications, from 2006 February to 2012 January (228 men, 97 women; average age: 57.4 year). According to the written results we classified the PET findings and separate those FDG-avid lesions, which aren't connected to the primary malignancies. Under the 2 years follow up we could define the incidentalomas exact locations, states and malignancies. The correct histological identifications and the long follow up time were essential in our study, because we could accurately isolate and evaluate the benign and malignant diseases from each other.

**RESULTS:** 119 abnormal, unexpected, focal lesions were confirmed in 112 patients out of 828. All in all 19 (5.6%) newly detected, separate, primary malignancies were certified, while 19 (5.6%) metastases and 82 (25.1%) benign diseases have been described as well. Locationally, greater part of the incidental lesions were found in the gastrointestinal system and in the head and neck region (35–36), while the respiratory- and urogenital system, the skin and other locations contained the remaining part (30%). In point of the digestive tract the most focal, FDG-avid findings were in the colon (24/42), but none of them was malignant, on the other hand the findings in the stomach and pancreas were decisively more aggressive. The head and neck lesions were often proved to be primary disease's metastasis (10/13). Surprisingly no histological confirmed malignant lesion was detected in the thyroid gland. The other findings in the suprarenal gland and in the lung were equally metastases and newly discovered, primary malignant tumours.

**CONCLUSION:** In summary, we can detect unexpected, incidental lesions in the third of the FDG-PET/CT scans. Most of them are benign, although significant part of these FDG-avid lesions, approximately and another third part of the all suspicious findings are progressive, malignant, pathological diseases, which raise the patients' mortality. The most false positive signs can be detect in the gastrointestinal system.

## T3-2

**PREDICTIVE ROLE OF FDG PET/CT IN HEAD AND NECK CANCER TREATED WITH RADIOTHERAPY — PRELIMINARY RESULTS**Zoltán Tóth<sup>1,2</sup>, Gábor Lukács<sup>3,4,5</sup>, András Kedves<sup>6</sup>, Miklós Emri<sup>1,2</sup>, Zsolt Cselik<sup>3,4</sup>, Gábor Tóth<sup>2</sup>, Éva Ferenczy<sup>7</sup>, Ferenc Lakos<sup>8</sup>, Janaki Hadjiev<sup>9</sup>, Imre Repa<sup>2</sup>, Árpád Kovács<sup>2</sup><sup>1</sup>PET Mediaparc Nonprofit Ltd., Health Center, University of Kaposvár<sup>2</sup>Department of Diagnostic Imaging and Radiation Oncology, Health Center, University of Kaposvár<sup>3</sup>Oncology Department, Somogy County Mária Kaposi Teaching Hospital<sup>4</sup>Radiation Therapy, Oncology Center Veszprém<sup>5</sup>Department of Medical Imaging, University of Debrecen<sup>6</sup>Medical Laboratory Diagnostic Imaging Analysis BSC, Department of Medical Imaging Kaposvár Campus, University of Pécs Faculty of Health Sciences<sup>7</sup>Dietrich School of Health Sciences, University of Pécs

**INTRODUCTION:** FDG PET/CT provides crucial information for the proper staging assessment and radiotherapy planning (RTP) of head and neck cancer patients. Our aim was to search for therapeutic outcome predicting parameters in the pre-treatment functional imaging data.

**METHODS:** Retrospective evaluation was performed using PET/CT image datasets of 21 head and neck cancer patients. PET/CT was acquired before the therapy, used for RTP and repeated 3–6 months after the completion of therapy for response evaluation. From the pre-treatment image datasets we assessed the SUVmax, SUVmean, Metabolic Tumor Volume (MTV) and Total Lesion Glycolysis (TLG) parameters of the primary tumor. According to the results of the therapeutic response evaluation PET/CT and the clinical follow up two patient subgroups were created in relation to the presence or absence of viable primary tumor tissue. Subgroup related metabolic parameter evaluation was performed (Wilcoxon test).

**RESULTS:** After radiotherapy in 10/21 cases viable residual tumor tissue was detected on the restaging PET/CT image dataset and 11/21 subjects reached complete remission. For the therapeutic success prediction assessment we were unable to find any correlation with pre-treatment SUVmax and SUVmean values ( $p = 0.55$  ill.  $p = 0.82$ ). MTV and TLG parameters however provided statistically significant differences between the two patient subgroups [MTV ( $p = 0.006$ ), TLG ( $p = 0.020$ )], as a summary MTV proved to be the most useful parameter for therapeutic response prediction.

**CONCLUSION:** Simple metabolic data provided by FDG PET/CT were unable to predict therapeutic response, while according to our preliminary results complex volume information containing parameters proved to be more useful for this purpose, thus their inclusion to risk stratification may have of additional value. Survey is planned to be followed with more subject and parameter evaluations.

## T3-3

**EVALUATION OF HEPATIC FDG UPTAKE DURING LYMPHOMA RESPONSE ASSESSMENT PET/CT**Zoltán Tóth<sup>1,2</sup>, Gábor Lukács<sup>3,4,5</sup>, Péter Rajnics<sup>6</sup>, Miklós Emri<sup>1,2</sup>, Zsolt Cselik<sup>3,4</sup>, Livia Zilahi<sup>7</sup>, Zsuzsanna Gábor<sup>8</sup>, Miklós Egyed<sup>9</sup>, Imre Repa<sup>2</sup>, Árpád Kovács<sup>2,1</sup><sup>1</sup>PET Mediaparc Nonprofit Ltd., Health Center, University of Kaposvár; <sup>2</sup>Department of Diagnostic Imaging and Radiation Oncology, Health Center, University of Kaposvár;<sup>3</sup>Department of Oncology, Somogy County Mária Kaposi Teaching Hospital; <sup>4</sup>Department of Haematology, Somogy County Mária Kaposi Teaching Hospital; <sup>5</sup>Radiation Oncology, Regional Oncology Center Veszprém; <sup>6</sup>Department of Medical Imaging, University of Debrecen; <sup>7</sup>Medical Laboratory Diagnostic Imaging Analysis BSC, Department of Medical Imaging Kaposvár Campus, University of Pécs Faculty of Health Sciences; <sup>8</sup>Dietrich School of Health Sciences, University of Pécs

**INTRODUCTION:** For the FDG PET/CT based visual therapy response assessment of lymphoma liver became the most important reference organ recently. The aim of the current project was to assess the stability of hepatic tracer uptake during chemotherapy treatments and to evaluate the potential change characteristics.

**METHODS:** Retrospective analysis was performed using the imaging data of 55 lymphoma patients (19 Hodgkin's disease, 36 Non-Hodgkin's lymphoma). All subjects underwent PET/CT for initial staging, after 2–4 cycles of chemotherapy for early response assessment and after completion of 6–8 cycles of therapy for restaging purposes. Hodgkin's disease patients received ABVD therapy, for Non-Hodgkin's lymphoma patients CHOP-based therapeutic regimen was administered. Mean and maximal hepatic standardized tracer uptake values (SUV) — using body weight, lean body mass and body surface area related normalization — were calculated with PERCIST liver reference ROI auto-segmentation tool of Syngo.via image processing application. The average hepatic Hounsfield values (HU) were also calculated using the same VOI on the low-dose CT images. For the evaluation of treatment associated hepatic SUV and HU changes one and two way Tukey's post hoc test was used after analysis of variance. One-way model was used when the type of lymphoma was ignored, and two-way method was assessed when the changes were examined within the two lymphoma subgroups.

**RESULTS:** None of the performed tests could reveal statistically significant alteration for any of the investigated SUVmax and SUVmean or average HU parameters. Further analysis was performed after creating 3 subgroups from the subjects according to the hepatic HU value changes. In the first group the reduction of hepatic average HU was larger than 10% (17 people), for the 2. group the HU value alteration was less than 10% (29 people). The 3. group contained the subjects with more than 10% increase in HU values (9 people). For the 1. group the reduction of HU values were found to be significantly lower during and after the treatment with  $p < 0.0001$  than the value before the treatment. However, changes in SUV values were not found to be significant within this subgroup, as patients with increased and decreased SUV values were also occurred. The other two (2–3) subgroups had no statistically significant HU change, due to small changes (2. subgroup), and as a consequence of low subject number (3. subgroup). **CONCLUSION:** The survey, containing the data of our own patient population reassuringly confirms the stability of liver activity during lymphoma response assessment FDG PET/CT examinations, we were unable to demonstrate any significant alteration restricting the further use of liver as a visual reference organ.