1. „ [68Ga]Ga-PSMA-11 PET/CT as a diagnostic method for assessment of treatment response to androgen deprivation therapy in male patients with prostate cancer (PC)"

The application of 68Ga-prostate-specific membrane antigen (PSMA) for evaluation response to androgen deprivation therapy (ADT) in males with prostate cancer (PC) is insufficiently reported in the literature. The aim of our research was to evaluate response to ADT in hormone-naive PC and to confirm the supposition of a distinctive response for various locations of PC involvement. The retrospective research concerned 55 male patients with PC who underwent a staging PSMA positron emission tomography/computed tomography (PET/CT) imaging and a follow-up restaging scan for evaluation of treatment response conducted in 3- 12 months after initiation of androgen deprivation therapy. Variations in radiopharmaceutical uptake were semiquantitatively assessed on twofold PSMA PET/CT scans. Overall 110 PET/CT scans of 55 males were assessed. Complete response (CR) was determined for males in accordance with the various localisations of PC involvement a median of 6 months after the initiation of androgen deprivation therapy: for the PC in prostate gland- 0,0%, for regional pelvic lymph nodes- 25,0%, for distant lymph nodes- 21,7%, for distant metastatic lesions (overall rate) - 14,3%. Disease progression (PD) was determined for males in accordance with the various locations of PC lesions. Treatment effect for regional lymph nodes was superior in M0 stage in comparison to M+ condition. Oligometastatic disease demonstrated better treatment effect in comparison to polymetastatic involvement. There was a positive correlation between the decrease in SUVmax of the primary PC in the prostate gland and the reduction in prostate-specific antigen (PSA) values. Malignant lymphadenopathy and distant metastatic involvement are more likely to respond to androgen deprivation therapy compared to primary tumor. Lesions with persistent prominent PSMA-expression can be a novel target for a discriminative local therapy of oligometastatic disease.

2. „The diagnostic value of (68)Ga-PSMA-11 (HBED-CC) PETCT in 133 patients with Biochemical Failure after radical treatment of Prostate Cancer"

The introduction of ^{68}Ga-PSMA PET/CT has significantly changed the landscape of prostate cancer (PC), especially for the early diagnosis and localization of disease recurrence. The main aim of this study was to analyze the diagnostic value of ^{68}Ga-PSMA- PET/CT in patients with PC undergoing imaging for biochemical failure after radical therapy and to define the predictive factors of ^{68}Ga-PSMA positivity in this context. We performed a retrospective analysis of 133 consecutive patients with biochemical recurrence (BCR) after curatively intended treatment of PC (surgery, radiotherapy or High-intensity focused ultrasound (HIFU) who underwent ^{68}Ga-PSMA PET/CT from July 2019 to August 2020. The mean age, median initial prostate-specific antigen (iPSA) and actual (aPSA) of the patients were: 67.3 years, 13 ng/ml and 2 ng/ml, respectively. Potential influences of several factors such as age, International Society Urological Pathology (ISUP) grade, Gleason score, T stage, aPSA value and androgen deprivation therapy (ADT) were evaluated. The detection rates were correlated with i/aPSA levels, PSA doubling time (PSAdt), ISUP grade, EAU (European

Association of Urology) risk groups, T stage and ADT. Univariate and multivariate statistical analyses were performed to assess parameters associated with PSMA-PET positivity. ^{68}Ga-PSMA PET/CT results were compared to CT findings. 68Ga-PSMA PET/CT detected recurrent disease in 90 patients (67.7%). In 43 patients (32.3 %) local recurrence was revealed. Metastatic lymph nodes incidence was 37 (27.8%). Bone metastases were observed in 43 patients (32.3%). Visceral metastases were revealed in 5 patients (3.7%). Tumor-detection was positively associated with iPSA and aPSA levels, whereas ISUP grade, T stage and EAU risk groups showed a trend towards significance. In multivariate analysis, aPSA levels at the time of the PSMA scan was the only significant predictor of a positive PET/CT study (p=0.02). PSMA-PET/CT provided superior detection of PC lesions than CT ^{68}Ga-PSMA PET/CT is an excellent tool for the detection of recurrent PC after treatment with curative intent even at low PSA levels. Tumor detection is positively associated with iPSA and aPSA levels. The aPSA value at the time of the examination appear to be the main predictor of ^{68}Ga-PSMA-positive findings.

3. „A pictorial view on false positive findings of Ga-PSMA-11 PET/CT and their prognostic value in patients with prostate carcinoma after radical prostatectomy and undetectable PSAvalues"

Recently, ^{68}Ga-PSMA-11 PET/CT has become a key imaging method in prostate carcinoma staging and biochemical progression, with varying sensitivities in different studies (from 40% to 80%). After four years of experience with ^{68}Ga-PSMA-11 PET/CT, we found that it is possible to detect lesions with increased PSMA expression in patients with undetectable PSA levels after radical prostatectomy. The key questions we wanted to answer were as follows: if those lesions were malignant and could the early detection of those malignant lesions have a role in patient management? We aimed to identify and follow up PSMA-positive findings for a period of 4 years in patients with prostate cancer after radical prostatectomy and undetectable PSA values at the time of the examination. We also explored false-positive lesions in detail. We found 15/40 (37.5%) patients with PSMA-positive findings. These were predominantly bone changes without a corresponding CT abnormality or discrete cystic or osteoblastic lesions with above-background increased PSMA expression. The mean SUVmax of these non-specific lesions was 3.02 (SD 2.86). After 3.5-4 years of follow-up, biochemical progression was found in only two of the patients.The great sensitivity of the method nowadays is a powerful engine for the development of new therapeutic options. On the other side, the lower specificity due to false positive findings, if misinterpreted, might lead to switching to a higher stage, with the planned radical treatment replaced by palliative treatment. The presence of ^{68}Ga-PSMA-11 PET/CT-positive findings in patients after radical prostatectomy and an undetectable PSA had a low predictive value for future progression. The interpretation of ^{68}Ga-PSMA-11 PET/CT should always include a complex assessment of the clinical setting-the risk group, PSA value and degree of PSMA accumulation in the lesions. In these situations, further clarification of PSMA-positive findings is appropriate before deciding to change treatment.

4. „Diagnostic and clinical value of [18F]FDG PET/CT in the follow-up regimen in IIA–IIID stage cutaneous malignant melanoma after first regional recurrence"

Malignant melanoma stands out as a disease with highly aggressive behavior and frequent recurrences. It is crucial to find a non-invasive method for early recurrence detection which allows early and radical treatment. Our aim was to assess the diagnostic and clinical value of [18F]FDG PET/CT in the follow-up regimen of patients after radically treated first regional recurrence and for early detection of operable disease progression. [18F]FDG PET/CT had better sensitivity, specificity, PPV and NPV, and accuracy in patients with symptoms. Good results in the second group had a high price for the patients, as there was a prevalence of distant metastatic disease in the second group - 64.0% vs. 28.3% in the surveillance group (p = 0.001). [18F]FDG PET/CT revealed more of the distant and in-transit lesions and assisted in lymph node detection by guiding the ultrasonography. Owing to the [18F]FDG PET/CT surveillance, 64.5% of all operable lesions were found in the surveillance group vs. only 35.5% in the second group, where the distant metastatic disease was prevalent. [18F]FDG PET/CT used as a follow-up tool in the surveillance regimen of patients after the first recurrence showed excellent performance in timely and accurate recognition of operable lesions. It had significantly better performance than conventional studies in the follow-up regimen of the patients in this high risk of progression group.

5. „IMPETUS- NEW VISUAL SCORE FOR INTERPRETATION OF 18F-FDG PET/CT IN PATIENTS WITH MULTIPLE MYELOMA"

Multiple myeloma (MM) is a malignant disease of plasma cells, leading to their uncontrolled proliferation in the bone marrow, production of excessive amounts of monoclonal paraprotein, destruction of bone integrity and displacement of other hematopoietic cell lines. PET/CT is currently being tested in patients with multiple myeloma and may detect early bone marrow involvement, assess disease activity, detects extramedullary involvement, or assess response to treatment. Recently, a group of Italian experts defined new visual descriptive criteria (Italian myeloma criteria for PET use or IMPeTUs) to standardize 18F-FDG-PET/CT assessment in MM patients. These include visual interpretation of images to quantify FDG fixation using the five-point Deauville (DS) scale proposed for the intermediate and final assessment of FDG-PET in lymphoma, together with morphological and anatomical aspects of FDG distribution in bone, diffuse bone marrow uptake, focal bone lesions (location, number and fixation), paramedullary or extramedullary lesions. In addition to being easily reproducible, IMPeTus criteria have also been used to determine positive cut-offs and therefore to identify patients with active disease, especially after therapy. IMPeTUs criteria have been proposed for simplification and standardization in the interpretation of 18F-FDG PET/CT scans in multiple myeloma. They are based on the Deauville scale and have been found to provide a significant prognostic index when radiolabel utilization remains high in bone marrow and/or focal hypermetabolic lesions, especially after therapy.

6. „18F-FDG PET/CT MAY HAVE A KEY ROLE IN DIAGNOSIS AND EVALUATION IN PATIENTS WITH POEMS SYNDROME- CASE REPORT"

Described by Crow in 1956 and Bardwick in 1980, POEMS syndrome is a rare paraneoplastic syndrome associated with an underlying plasma cell dyscrasia. The aim of this study was to demonstrate the important contribution of ^{18}F-FDG PET/CT in the diagnosis of a patient with POEMS syndrome, by providing a whole body anatomical and metabolic imaging and detecting suspicious bone lesions, organomegaly, lymphadenopathy and skin lesions, which play a key role for providing the diagnosis. We present a case of a 47-year-old man referred for ^{18}F-FDG-PET/CT in order to clarify mixed osteoblastic/osteolytic lesions in vertebrae detected by another imaging method. ^{18}F-FDG PET/CT showed multiple diffuse mixed osteoblastic/osteolytic lesions with increased glucose metabolism, benign generalized lymphadenopathy, splenomegaly, and a skin lesion on the right thigh. Based on clinical, laboratory, and imaging findings, a diagnosis of POEMS syndrome was made. As a whole-body scanning modality, ^{18}F-FDG PET/CT has the advantage in the evaluation of multisystem, particularly hematological, diseases such as lymphomas and multiple myeloma. Furthermore, ^{18}F-FDG PET/CT can visualize important features of POEMS syndrome, especially bone lesions. ^{18}F-FDG PET/CT may have a key role in the diagnosis and evaluation of this rare and unique syndrome by providing anatomical and metabolic imaging of the whole body.

7. „TOTAL BODY 18F-FDG PET/CT IN A PATIENT WITH MULTIPLE MYELOMA - WHEN AND WHY IS IT NEEDED?"

Multiple myeloma (MM) is a malignant disease of plasma cells in which they proliferate in the bone marrow, disrupting the normal balance between bone formation and bone resorption. As a result of this imbalance, bone integrity weakens and becomes more prone to fracture, even with minimal trauma or stress. Fractures can be painful and cause further complications. The clinical case presents the possibilities of the hybrid imaging modality ^{18}F-FDG PET/CT in the evaluation of multiple myeloma. There is still no established standard for the extent of the scan field in patients with MM. Our recommendation is for the patient to have clinical complaints of lower extremity pain or evidence of diffuse bony involvement, the scan field should extend from the vertex to the distal third of the tibia. In this way, the diagnosis, follow-up and therapeutic approach to the patient will be improved, as the osteolytic lesions on long bones, which can easily lead to fractures, operative interventions and impaired quality of life, are detected in a timely manner.

8. „^{68}Ga-PSMA-avid synchronous rectal cancer: incidental malignancy in prostate cancer staging"

PSMA has been revealed in tumor-related neovasculature cells of the endothelium in different nonprostatic cancerous tumors, along with colorectal malignancy and numerous subtypes of solid neoplasms. Our aim is to present an uncommon clinical case of occasional synchronous

cancer with increased ^{68}Ga-PSMA-uptake during primary staging for prostate cancer (PC). PSMA PET/CT revealed focal intense PSMA activity associated with a rectal tumor and a pelvic lymph node with high uptake of the radiopharmaceutical. These findings thereafter histologically confirmed as moderately differentiated synchronous colorectal adenocarcinoma with related metastatic regional lymph node in the pelvis and free intraperitoneal fluid. The present case demonstrates the importance of accurate interpretation and analysis of ^{68}Ga-PSMA PET/CT scan results, as well as judgment for histological verification of incidentally identified tumor structures with increased PSMA-expression. This clinical case with significantly elevated non-prostatic PSMA activity highlights the importance and necessity of careful interpretation of PSMA PET/CT results. It also suggests the potential role of PSMA-targeted radioligand therapy in progressive advanced colorectal carcinoma.

9. „The application of ^{18}F-Fluorodeoxyglucose (FDG) PET/CT in Pulmonary Langerhans cell histiocytosis (PLCH) - a case report and literature review”

Pulmonary langerhans cell histiocytosis (PLCH) is a clonal process and may occur as part of multisystem Langerhans cell histiocytosis (LCH) or, more frequently, presenting as single-system PLCH with frequent respiratory symptoms, and uncommon complication as pneumothorax. The aim is to present a rare clinical case of PLCH studied with ^{18}F-fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT). A 18-year-old man with diagnosed left-sided pneumothorax, with subsequent onset of right-sided pneumothorax one month later. Diffuse changes were detected in both lungs by conventional imaging studies, which were subsequently histologically verified as LCH involvement. FDG-PET/CT detected numerous cavitating lesions bilaterally in lung, reticulonodular opacities with increased glucose metabolism with LCH appearance. Pleural involvement was suspected from the underlying disease. A restaging FDG PET/CT scan was performed, (with application of SUVmax lung /SUVmax liver index values), which was defined as stable disease (SD). ^{18}FDG PET/CT seems as valuable and promising imaging modality for the staging/ initial evaluation of PLHC, as well as for the restaging/ assessment of therapeutic response. The measurement of SUVmax lung /SUVmax liver index values and its monitoring showed a high potential for application as a simple, non-invasive screening method supporting early diagnosis, evaluation and monitoring of therapeutic response of patients with PLCH.

10. "Capabilities of [18F]FDG-PET/CT imaging in patients with multiple myeloma referred to staging and restaging due to suspected progression"

Multiple myeloma (MM) accounts for approx. 10% of hematological malignancies. International Myeloma Working Group has emphasized the need for further studies before PET can be recommended as a standard tool in both the di- agnosis and follow-up of patients with MM. The aim of this study was to investigate the feasibility of [18F]FDG-PET/CT in patients referred for staging and due to clinical/laboratory evidence of relapse or progression

of MM. We set out to establish the sensitivity, specificity, positive and negative predictive value, and accuracy of [18F] FDG-PET/CT in these cases. In patients referred for staging, we found sensi- tivity and accuracy of the hybrid imaging method 72.97% and 72.97%, respectively. A comparison of the obtained sensitivity data for detecting osteolytic lesions by radiography and [18F]FDG-PET/CT was performed, and a statistically significant difference was found between them, in favor of the hybrid imaging method (p = 0.049). We compared the obtained sensitivity data for detection of osteolytic lesions from previously performed computed tomography (CT), magnetic resonance imaging (MRI) and [18F]FDG-PET/CT, finding no significant difference (p = 0.09; p = 0.29). Based on the findings, we calculated, respectively, sensitivity 54.55%, specificity 69.23%, positive predictive value 60%, negative predictive value 64.29% and accuracy 62.5% of the imaging method when restaging patients with suspected MM progression. Data from our study show that [18F]FDG-PET/CT has significantly greater sensitivity than conventional radiography in staging. [18F]FDG-PET/CT is a useful method in identifying disease progression, allowing prognostic stratification of patients after maintenance therapy or autologous/allogeneic stem cell transplantation. We recommend the incorporation of this new imaging technique into the diagnostic plan of MM due to its higher sensitivity and ability to detect bone disease in an earlier phase compared to radiography. Our calculated sensitivity of 54.55% of the imaging method approaches the described studies, providing evidence to support the possible use of [18F]FDG-PET/CT in patients referred for restaging due to suspected progression or relapse after treatment.

Publications and reports published in scientific resources, referenced and indexed in world- renowned databases with scientific information/ G 7.

1. „Gallium-68 [68Ga] labeled prostate specific membrane antigen (PSMA)-11 PET/CT in primary nodal and distant staging of prostate cancer (PC) patients compared to conventional imaging modalities (CT, MRI, bone scintigraphy): a retrospective single center study"

Accurate clinical staging have a major importance for prognosis assessment and treatment recommendations for patients with PC. The prostate-specifc membrane antigen (PSMA) is a cell surface glycoprotein that is highly expressed by prostate epithelial cells and is a promising target for PC. The aim of this study was to assess the performance of 68Ga-PSMA-PET/CT for primary locoregional nodal (N) and distant (M) staging of intermediate and highrisk PC compared with conventional imaging techniques, as well to estimate the risk of metastatic involvement based on PSMA PET/CT fndings. Regional metastatic incidence was identified in 29 (42.0%) of males with high-risk PC, including 24 (34.8%) with a PSA level of >10 ng/ml and 23 (33.3%) with ISUP grade 4-5. Distant metastatic disease was identified in 31 (44.9%) of males including 24 (34.8%) with a PSA level of >10 ng/ml and 25 (36.2%) with ISUP grade 4-5. Based on conventional imaging, 14 patients (20.3%) were staged as positive, 9 (13.0%) as equivocal and 46 patients (66.7%) as negative for nodal metastases. With additional information of the PSMA PET/CT, N status was upstaged in 16 (23.2 %) and

down staged in 5 (7.2 %). Based on conventional imaging, 22 patients (31.9%) were staged as positive, 11 (16.0%) as equivocal and 36 (52.2%) as negative for distant metastases. With additional information of the PSMA PET/CT, M status was upstaged in 18 (26.1%), and down staged in 8 (11.6%). Significant differences in N and M staging frequencies were found for CT, MRI and BS compared to PSMA PET/CT. ^{68}Ga-PSMA PET/CT is a promising molecular imaging technique that outperformed conventional imaging in the detection of nodal and distant metastases in the initial staging of patients with intermediate and high-risk PC. The detection of locoregional nodal and distant metastatic spread of PC is positively associated with PSA levels and ISUP grade.

2. „68Ga-PSMA PET/CT in primary staging of prostate cancer (PC) patients: risk of metastatic disease"

Accurate primary staging of prostate cancer (PC) is one of the most important issues for clinical management of patients. The aim of this study was to analyze the association between PSA values, clinical T stage, European Association of Urology (EAU) risk groups and International Society of Urological Pathology (ISUP) grade in locoregional nodal (N) and distant (M) staging of PCa with 68Ga-PSMA PET/CT detection rate and metastatic lesions incidence in patients with intermediate and high risk disease. Distant lymph nodes were most commonly found in patients with a PSA level of >20 ng/mL and with ISUP grade 4-5. Visceral metastases were detected in 4 (3.7%) of males with a PSA level of >20 ng/mL and ISUP grade 4-5. Distant metastases as a whole were seen most commonly in patients with high levels of PSA and ISUP grade 4-5. This study confrms that ^{68}Ga-PSMA PET/CT is an excellent tool for the detection of metastatic lesions, oligometastatic disease in the initial staging of patients with high-risk PC. The detection of locoregional nodal and distant metastatic spread of PCa is positively associated with PSA levels, ISUP grade and EAU risk groups.

3. „The role of 18F-FDG PET/CT in diagnosis and evaluation of an unsuspected secondary cutaneous lesion in a patient with tumor of unknown origin (TUO) in times of COVID-19 pandemic - a case report"

Herein, we aimed to report the advantages of 18F-FDG PET/CT for fnding a proper biopsy place and accurate staging of a tumor of unknown origin (TUO). Moreover, PET/CT was able to reveal an unsuspected secondary skin lesion, not reported in clinical exam, due to the necessity of wearing face masks owing to coronavirus 2019 disease (COVID-19). ^{18}F-FDG PET/CT is an irreplaceable imaging modality for evaluating patients with TUO. In this case, we showed the important role of 18F- FGD PET/CT for fnding a proper biopsy place, accurate staging and evaluating of an unnoticed prior the exam, non Hodgkin lymphoma skin involvement.

4. „Comparison between the efficacy of physical examination/endoscopy with the efficacy of FDG-PET/ CT for the identification of recurrence in head and neck squamous cell carcinoma after curative treatment"

The aim of our study was to compare the efficacy of physical examination/endoscopy (PE/E) with the efficacy of fluorodeoxyglucose (FDG)-positron emission tomography/computer tomography (PET)/ CT) for the detection of recurrence in head and neck squamous cell carcinoma (HNSCC) after curative treatment. We retrospectively reviewed total 21 curatively treated patients with primary head and neck squamous cell carcinoma. PET/CT correctly identified local recurrence of the head and neck squamous cell carcinoma in 16 cases, 1 false positive and 4 true negative findings, there were no false negative results. Physical examination/endoscopy demonstrated 13 true positive, 5 false positive, 3 false negative and 0 true-negative findings in a patient-basis. The sensitivity, specificity, accuracy, positive and negative predictive values for detecting local recurrence were 100%, 80%, 95%, 94% and 100%, respectively, for PET/CT versus 81%, 0%, 62%, 72%, and 0%, respectively, for PE/E. FDG- PET/CT scan identified sites suggestive local recurrence of HNSCC in 17 patients. The malignancy was located in the following localizations: larynx (n=6), nasopharynx (n=2), oropharynx (n=3) and oral cavity (n=6). FDG PET/CT has a high sensitivity and negative predictive value in the identification of the local recurrence in patients with head and neck squamous cell carcinoma and it is effective non-invasive method even if there is a diagnostic doubt after physical examination/ endoscopy.

5. „Detection of Second Primary Tumors in patients with head and neck cancers using FDG PET/CT as a screening imaging tool"

The purpuse of this study was to assess the efficacy of ^{18}F fluorodeoxyglucose positron emission tomography and computed tomography (PET/CT) in detecting second primary tumors in patients with head and neck cancers (HNC). Retrospectively we analyzed 120 patients with initial HNC diagnosed between 2015-2017. FDG PET/CT correctly identifed unexpected second primary cancers in 8 of these 9 patients, there was 1 false positive result. Most common localisation of the second primary malignancy were colorectal region 50%, thyroid gland 12.5%, lung 12.5%, head and neck 12.5% and renal 12.5%. FDG-PET/CT showed a sensitivity of 100%, a specificity of 99%, a positive predictive value 88.9%, a negative predictive value 100% and accuracy 99% identifying additional primary malignant neoplasms. The non-invasive whole body FDG-PET/CT is an useful as a screening imaging tool for detecting unexpected second primary malignancy in patients with Head and neck tumors.

6. „Delayed complete metabolic response assessed with 18F-FDGPET/CT in two time-points in patients with malignant epithelial head and neck tumorafter radiotherapy with or without systemic chemotherapy three clinical cases"

We present three patients with malignant epithelial head and neck cancer (MEHNC) treated with radiotherapy with or without chemotherapy. We assessed the treatment response with

FDG-PET/CT in two time-points, after end of therapy and after folow-up period. The timing of post-treatment response assessment represents balance between allowing time for completion of tumour response and resolution of radiotherapyrelated infammation versus the need to assess response early enough post-treatment to allow potential surgical intervention in the event of an incomplete response. The challenge of determining the presence or absence of viable tumour following radiotherapy provides a powerful rationale for the incorporation of functional imaging into response assessment protocols. Our three clinical cases demonstrate that we must careful monitoring with FDGPET/CT the completion of treatment in two-time points to ensure timely initiation of salvage therapy for persistent or progressive disease. We advise careful observe responding tumor after therapy for meantime 12 months to enable patients with delay CMR to avoid unnecessary treatment.

7. „Ga-68 PSMA-avid Serous Cystadenoma of the Pancreas and Ga-68-PSMA PET/CT negative multiple myeloma in patient with biochemical recurrence of prostate cancer"

^{68}Ga-PSMA PET/CT has shown excellent results in imaging of prostate cancer (PC). Biochemical recurrence (BCR) is the main indication for the novel imaging modality. Prostatespecifc membrane antigen (PSMA) is a type II transmembrane glycoprotein that is overexpressed in PC cells. Various benign and malignant pathologies have also been described to show increased PSMA activity, possibly due to tumor-associated angiogenic factors and endothelial cell proliferation. The aim is to present an uncommon clinical case of serous cystadenoma of the pancreas showing intense tracer uptake and PSMA PET/CT negative multiple myeloma (MM) after chemotherapy. Incidental lesions on ^{68}Ga-PSMA PET/CT in PC patients are not rare and should elicit a wide diferential diagnosis including benign and malignant diseases. The degree of tracer uptake is not reliable for diferentiating between them and PC lesions, which is of considerable clinical importance. Comprehensive anamnesis and individual approach are required in order to prevent misinterpretation and misdiagnosis.

8. „FDG-avid lymph nodes (LN) in response to vaccines for SARS-CoV-2"

Vaccines against SARS-CoV-2 virus were developed due to the impetuous coronavirus pandemic. Vaccines hold a possibility to provoke side efects. The aim of our study was to examine the impact of COVID-19 vaccination on the incidence and duration of false-positive FDG-avid lymphadenopathy after vaccination with diferent types of vaccines and to determine its relationship with age, gender, and vaccine type. The retrospective study included 103 patients who met the following criteria: 18F-FDG PET/CT scan performed (in the period from August 2021 to December 2021) for staging or restaging of diagnosed oncological diseases at diferent time periods after vaccination Pfzer-BioNTech, Moderna-BioNTech and Oxford-AstraZeneca. False-positive reactive lymphadenopathy was identified in 35 (34%) of 103 patients included in our study cohort, which occurred during the first 2

weeks to 12 weeks after vaccination and manifested as increased metabolic activity in regional non-enlarged lymph nodes: ipsilateral axillary lymph nodes of levels I-III, as well as cervical LN of levels IV and VB). A significant moderate decline in metabolic activity in the LN over time was reported, as well as a decrease in the detection rate of PET-positive reactive findings with time. The results showed a trend of a positive relationship - the occurrence of reactive lymphadenopathy more often in women than in men. The detection rate, as well as the intensity of the activity of glucose metabolism, were higher in patients under the age of 50 compared to those ≥ 50 years. However, we did not find significant differences between the studied types of vaccines (p >0.05). Multidisciplinary physician awareness is essential regarding the possibility of false-positive FDG lymphadenopathy in relation to local infammation and as a manifestation of the immune response due to COVID-19 RNA vaccination and adenoviral vector-based vaccine up to 12 weeks after injection, in order to optimize the clinical interpretation of hybrid scan results that determine the subsequent therapeutic approach of cancer patients. The results of the present study demonstrate the importance of vaccination on the contralateral side of the tumor drainage, as well as taking a thorough anamnesis.

9. „68Ga-PSMA PET/CT scan in patients with high-risk prostate cancer (PC) with ISUP grade 5"

International Society of Urological Pathology (ISUP) grade is the superior predictor for advanced disease at diagnosis. The aim of our study was to investigate the role of [68]GaPSMA PET/CT in patients with high risk PC with ISUP grade 5 in diferent diagnostic groups of patients: to determine the relationship between prostate specifc antigen (PSA) and the detection rate for the diferent localizations of malignant involvement of the PC, as well as to analyze the features of nodal and bone metastasis. We found the highest detection rate for distant metastases in all groups of patients and in the assessment of the whole cohort 43 (70.5%). In patients in group II, a statistically signifcant positive association was found between PSA values and the detection rate for distant lymph nodes (LN) (p = 0.041), distant metastases in total (p=0.002), and for total detection rate (positive PSMA-PET/CT results), p = 0.002. ^{68}Ga-PSMA PET/CT is an excellent imaging method for PC detection in patients with ISUP grade 5 with BHR and for PC staging. The results of the present study showed a relatively high incidence of falsenegative findings (mostly bone lesions), which requires special attention during interpreting the results.

10. „Why to include the brain in 18F-FDG PET/CT PET/CT scanning protocol in cancer patient ?- a case report"

Metastases to the brain can afect about 10-20% of all cancer patients and 1% of all head and neck squamous cell cancer (HNSCC) cases. In patients with extracranial malignancies detection of brain metastases is very important in deciding further diagnostic procedures,

planning therapeutic strategies and also to ascertain prognosis. Time between initial diagnosis of HNSCC and BM development can vary considerably. Some patients experience more than a decade of disease-free survival, whereas others present with defnitive neurological symptoms that precede primary tumor detection. We report a man, aged 75 years, restaged with FDG-PET/CT for laryngeal cancer, T2N0M0, underwent defnitive radiotherapy 4 years ago. The whole body FDG-PET/CT scan identifed hypermetabolic focus in the grey matter, suspected for brain metastasis or primary brain tumor (with no symptoms). The histopathological reported revealed of Glioma grade IV. The FDG-PET/CT scans cannot distinguish brain metastasis from a primary brain tumor, but early diagnosis of brain malignancy will lead to early treatment and a better prognosis for the patient. It is recommended the brain to be included in FDG-PET/CT scanning techniques in cancer patients.

11. „A rare case of McCune- Albright Syndrome and use of99 Tc MDP whole- body scintigraphy for the mapping of bone involvement"

McCune-Albright syndrome (MAS) is a rare genetic disorder caused by a mutation of the GNAS1 gene, afecting the bones, skin and endocrine system. The clinical spectrum includes fbrous dysplasia of bone, areas of of abnormal skin pigmentation (café-aulait macules), and precocious puberty. The aim of this study is to show the crucial role of 99 Tc MDP bone scintigraphy for diagnostic accuracy in the evaluation of patients with MAS syndrome. Skeletal abnormalities associated with McCune Albright syndrome could afect all bones in the skeletal system and their assessment is crucial for the diagnosis of MAS. Diferent imaging methods could be used to diagnose fbrous dysplasia but only a whole-body bone scintigraphy is able to evaluate the extent of the disease in a single examination, thus allowing a better management in assessing the prognosis of the patient and making treatment decisions.

12. „Impact of 68Ga-PSMA-11 PET/CT on salvage radiation treatment concept in males with early biochemical relapse of prostate cancer after radical prostatectomy"

Salvage radiation treatment (SRT) is well settled in males with biochemical recurrence (BCR) after radical prostatectomy (RP) in the absence of distant metastases. The aim of this study was to assess the impact of ^{68}Ga-PSMA-11-PET/CT on SRT concept in males with early biochemical relapse in the low-range values up to prostate-specifc antigen (PSA) ≤ 0.5 ng/ ml after RP. Without taking into account the results of the PSMA PET/CT, all 85 patients would have been referred for RT: 65 (76.5%) to the prostate bed and seminal vesicles fossa only, and 20 (23.5%) furthermore to the regional pelvic lymph nodes due to high-risk histopathologic features. A total of 44 patients (51.8%) showed at least one positive lesion. ^{68}Ga-PSMA PET/CT detection rate varied according involved regions as follows: local recurrence- 21.2% (18) : in the prostate bed- 11.8% (10) in the seminal vesicle fossa- 9.4% (8), lymph node metastases: regional- 12.9% (11), distant- 9.4% (8); bone metastases- 20.0% (17), distant metastases as a whole- 23.5% (20). Additional data from ^{68}Ga-PSMA-11-PET/CT guide to alter of RT planning in 28 (32.9%) males. There were modifcation with mild adaptation of

RT, included the supplementary inclusion in the irradiated area of seminal vesicle fossa in 8 patients (9.4%). The signifcant diferences in the target volume included the supplementary RT of lymph nodes or the added or particular RT of bone metastatic lesions in 20 patients (23.5%). PSA response was achieved in 47 (92%) patients from the available PSA levels in 65 patients 6 months after accomplishment of SRT. ^{68}Ga-PSMA-11-PET/CT showed a high impact on SRT concept in males with early biochemical relapse of PC after RP. A change in the treatment planning was indicated in 32.9% of patients with BCR at PSA levels ≤ 0.5 ng/ml. Thus, PSMA PET/CT can signifcantly contribute to a personalized approach in RT planning, which may improve progression-free survival.

13. „The role of 18F-FDG PET/CT in changing the therapeutic plan in cutaneous melanoma patients at diferent clinical stages and time points of the disease"

A definite survival beneft has been found in patients with cutaneous melanoma (CM) after radical metastasectomy, with 2-year survival as high as 50%. Therefore, it is important to identify the group of metastatic patients who would have a chance for radical surgery. In most cases ^{18}F-FDG PET/CT upstages the patient, which leads to the redirection to targeted and immunotherapy that could improve signifcantly the one-year survival rates from 25% to over 70%. Our aim was to investigate the role of ^{18}F-FDG PET/CT in changing the therapeutic plan in CM patients at diferent clinical stages and time points. 18F-FDG-PET/CT lead to change in treatment plan in 302 (87.8%) patients. The results demonstrated that the change correlates with the advanced initial stage of the patient. Notably, in patients with stage IIC and higher, 18F-FDG PET/CT significantly influenced the therapeutic decisions in over 83.0 % (p=0.035). We had data on the type of treatment changed in 280 of the patients. Stage II diagnosis was predominated by an earlier finding of operable lesions (56.09%- 65.3%). In patients diagnosed in stage III, 18F-FDG PET/CT was associated with a more frequent conversion to systemic treatment (59.3%.-85.7%). At staging a substantial amount of patients required additional surgical treatment (43.3%) or systemic treatment- 23.3%. In patients referred for suspected progression, we identified a similar number of cases suitable for surgery (36.4%) and systemic treatment in 40.3%. Among the patients after the first and second relapse, those suitable for systemic treatment or for changing the latter significantly were respectively 53.4% and 66.7%. ^{18}F-FDG PET/ CT is a whole body scanning and very sensitive procedure for CM because of their high glucose metabolism, which permit visualization the whole body, including the limbs, and allow the detection of small subclinical metastases. This study elicits the substantial role of 18F-FDG PET/CT in CM therapy management and precise redirection of patients to the most appropriate therapy for extending of their life expectancy.

14. „18F-FDG- PET/CT guided biopsy has an essential role in the diagnosis of primary extranodal difuse large B-cell lymphoma of bone- a clinical case"

Primary bone lymphoma exclusively afects skeletal tissue. It is a rare disease, estimated to be 3-7% amongst primary bone tumors and less than 2% amongst all lymphomas in adults. [1] We present a case demonstrating the clinical impact of 18F-FDG PET/CT in the multimodality approach to the diagnosis of primary extranodal difuse large B-cell lymphoma of the left hemipelvis. As it was stated in the literature, the diagnosis of primary bone

lymphoma was delayed due to unspecifc clinical signs and equivocal imaging fndings. 18F-FDG PET/CT acted as a key imaging method in the multidisciplinary management, guiding the biopsy, which fnally led to the correct diagnosis.

15. „18F-FDG PET/CT assessment of metabolic activity of the osteolytic lesions in patients with multiple myeloma after treatment for evaluation tumor vitality"

We aimed to determine the cut-of value of the glucose metabolism, assessed by value of SUVmax and 5-point scale (FPS), to evaluate the vitality of multiple myeloma (MM) after treatment. The results of the ROC curves of the SUVmax showed that the method is reliable and have a high degree of predictability (p=0.000). Most patients evaluated with score 4 and 5 have established IMR. On the other hand, all patients evaluated with score 2 and 3 fall into the group with established CR. We determined that CMR can be predicted for a SUVmax below 2.95, and an IMR - for a SUVmax equal to or above 3.12. A CMR with a high probability can be predicted with a visual assessment score of 1-2, and an IMR - with a score 3 and higher (score 4 and 5). We advise that with a result in the gray zone of a borderline metabolic response (FPS=3 and SUVmax between 2.95-3.12) it is appropriate to repeat the test in the shortest possible time (up to 2-3 months) in correlation with laboratory tests. 18F-FDG PET/CT is considered as a standard technique for evaluating and monitoring the metabolic response to therapy in patients with MM. In this regard, standardization of interpretation criteria and determination of positive/negative thresholds are of great importance.

16. „18F-FDG PET/CT maybe not so helpless in detection leptomeningeal metastasis- a case report"

Leptomeningeal metastasis represents secondary infltration by neoplastic cells in meningeal space. The gold standard for diagnosing the involvement of the meninges is cerebrospinal fuid analysis and contrast enhanced-magnetic resonance imaging (MRI). Herein, we aimed to report the usefullness of 18F-FDG PET/CT for fnding out leptomeningeal carcinomatosis in a patient with extraosseous plasmocytoma. This case report shows that head and neck as well as whole body 18F-FDG PET/CT can be used as an additional diagnostic tool for raising a suspicions of leptomeningeal carcinomatosis or as a primary diagnostic method in cases when cerebrospinal fuid analysis or contrast enhanced-magnetic resonance imaging can`t be performed.

17. „ 18F-FDG PET/CT in unknown primary suspected of multiple myeloma"

In the present study, we aim to evaluate the role of 18F-FDG PET/CT in patients with osteolytic lesions of unknown origin, suspecious of multiple myeloma. 18F-FDG PET/CT is a non-invasive and highly sensitive examination of the whole body, allowing not only the detection of the primary tumor, but also its simultaneous staging and 18F-FDG PET/CT directed biopsy. In patients with unknown primary carcinoma, it should be used as the first imaging modality of choice. In the present study, we found that 18F-FDG PET/CT helped in

the diagnosis of 57.6% (n=19) of the patients and the specifcity and positive predictive value of 18F-FDG PET/CT method were 64.29% and 79.17%.

18. „18F-FDG PET/CT assessment of metabolic activity of the osteolytic lesions in newly diagnosed multiple myeloma patients as predictive factor for overall survival"

Our aim was to assess the impact of metabolic activity of osteolytic lesions found by staging 18F-FDG PET/CT and assessed by visual scale or semiqualitative value (SUVmax) as a predictor for overall survival (OS) in newly diagnosed multiple myeloma (MM) patients. In our study, we found that patients evaluated with score 5 (5-PS) of osteolytic lesions had signifcantly lower OS than those with scores 3 and 4. Also an average value of SUVmax of 4,20 showed a trend in patient stratifcation, with those with a lower SUVmax cut-of having greater overall survival.

19. „A rare fnding in 18F-FDG PET/CT restaging - unilateral diaphragmatic crura increased uptake in patient with pneumonectomy - a Case report"

The knowledge of normal and pathological uptake of F-18 fuoro-2-deoxy-glucose (18F-FDG) whole-body positron emission tomography (PET) with computed tomography (CT) is essential for identifcation of the presence and extent of malignant disease. The advantages of combining functional and anatomical information can help us to precisely localize and stage primary non-small-cell lung cancer, fnd a proper biopsy place, evaluate the tumor response after treatment and help in radiotherapy planning. However, there are some artefacts and pitfalls which can easily misguide the 18F-FDG-PET/CT interpretation. This rare and unusual case report of unilateral diaphragmatic crus increased uptake after pneumonectomy enriches the knowledge of possible artifacts and pitfalls. It gives us the opportunity to be more precise in 18F-FDG- PET/CT post treatment restaging, which is always a challenge.

20. „Osteomyelitis in patient with multiple myeloma- the invisible threat seen in 18F-FDG PET/CT"

Herein, we aim to present a rare PET/CT fnding in a patient with multiple myeloma (MM)-osteomyelitis of the sternum. Patients with MM who are immunocompromised by chemotherapy, transplantation, or steroid drugs may be susceptible to infections. Vertebral osteomyelitis of bacterial or fungal origin is particularly specifc in immunocompromised patients [1]. Medical literature rarely highlights the risks of bone infection associated with myeloma bone disease. Although the literature to date consists mainly of individual case reports rather than rigorous prospective studies, it is suggested that this may be an area that merits further investigation.

21. „18F-FDG PET/CT in a patient with two metachronous tumors and the possible diagnostic pitfalls"

We aim to present a case of a patient with two metachronous malignancies and the possible diagnostic pitfalls in the interpretation of 18F-FDG PET/CT images. The combination of these two types of carcinoma in one patient is rare. Usually, the second neoplasia is caused by immunosuppression as a result of treatment (chemotherapy, radiotherapy) of the frst. Multiple myeloma and renal cell carcinoma have similar risk factors (obesity, smoking, hypertension). Pathophysiological mechanisms are common to both renal carcinoma and multiple myeloma— in particular, the role of interleukin-6, which is produced by renal cells and stimulates the proliferation of myeloma cells. This should direct the clinicians attention to the possibility of recurrence of one malignant disease, even though progression of the other metachronous tumor is subsequently proven.

22. „Expect the unexpected- a rare case of incidentally detected recurrent bone invasive giant meningioma on F-18 FDG PET/CT, in a patient with stomach neoplasm"

Meningioma is a primary neoplasm of the central nervous system. Up to 3% of people over 60 are thought to be at risk for asymptomatic meningioma. However, even after perfect resection, there is between 9% and 32% risk or recurrency in the 15 years post-surgery. Still, the extent of bone involvement, calcifications and the giant size of the reccurent meningioma reported in this paper are of much lower incidence. Unexpected fndings, often without increased uptake, are not infrequently encountered in PET/CT imaging. However, the dimensions and complicity of the meningioma described here are quite rare. Although this is a "can't miss fnding" it comes to remind us that underneath any oncological condition there could be additional lesions which are sufcient enough to prompt a systematic review of the CT images obtained during the PET/CT study. Check your CT imiges twice, print your report once!

23 *„Novel hybrid imaging method 68Ga-PSMA PET/CT as a breakthrough in the diagnosis of prostate cancer"*

In recent years, PSMA PET/CT has been making ground-breaking changes in the diagnosis, staging and restaging of prostate cancer patients. PSMA represents an excellent biological target for high quality PET imaging of PC. The motivation for writing the article is the lack of scientific literature in Bulgarian sources about this topic. The main aim is to present the scientific achievements of the topic and the accumulated experience worldwide. Analytical-synthetic processing of the documentary sources and systematic exposition of the summarized content was performed. An analytical and partly critical assessment of key research and problematic issues requiring further research has been conducted.

1. „18F-FDG PET/CT in pathological fractures from multiple myeloma"

Multiple myeloma (MM) is a malignant disease of plasma cells, characterized by their uncontrolled proliferation in the bone marrow, leading to bone destruction. In MM, the interaction between malignant plasma cells and the bone microenvironment leads to osteoclast bone destruction, reduced osteoblast function, and blockage of bone regeneration. This imbalance, together with decreased bone mineral density and treatment-related factors such as glucocorticoid therapy, can lead to MM fractures. The aim of our study was to evaluate the characteristics, distribution, and frequency of pathological fractures in patients diagnosed with multiple myeloma. The study found that the most common pathological fractures are in the vertebrae. No correlation was found between the clinical stage, laboratory results (hemoglobin, lactate dehydrogenase, creatinine, and alkaline phosphatase), and SUVmax values in pathological fractures. The study was retrospective and based on a small cohort of patients. We cannot be sure whether our conclusions are applicable to other or larger cohorts. More research is needed to confirm our findings.

2. „Evaluation of hybrid PET/CT imaging with the 68Ga-labelled PSMA ligand in patients with prostate cancer and biochemical progression in the low-range values of PSA after radical prostatectomy"

Currently ^{68}Ga-PSMA PET/CT is making a significant shift in the diagnosis, staging and restaging of prostate cancer (PC) patients. Many questions have been raised concerning the indications and the sensitivity of the method. Most of them are related to the PSA values in biochemical progression, specifically in the low PSA values of up to 2.00 ng/mL. The aim of this study was to analyze the influence of PSA values in biochemical progression on ^{68}Ga-PSMA PET/CT sensitivity, detection rate and the association with regional or metastatic lesions incidence in patients after radical prostatectomy (RP) with a focus on the impact of the lower ranges of the PSA values. This study confirms that ^{68}Ga-PSMA PET/CT is a superior method for diagnosing recurrent prostate carcinoma and metastatic involvement with high sensitivity, even at low PSA levels, which may influence subsequent therapeutic approaches. The detection rate of recurrent PC is positively correlated with PSA levels. ^{68}Ga-PSMA PET/CT can be applied in men with low but rising PSA levels.

3. „Monitoring the effect of therapy on a patient with a neuroendocrine tumor of the pancreas with PET/CT, 68Ga-DOTATATE - case report"

Neuroendocrine tumors (NET) are a rare diagnosis, often without symptoms or mimicking other different symptoms. They are a heterogeneous group of tumors derived from neuroendocrine cells, most commonly of the gastrointestinal tract, but may originate also

from other organs including the pancreas, lungs, ovaries, thyroid, pituitary, and adrenal glands. Due to the difficult diagnosis, NET's are detected at a late stage in their development, often already locally advanced or metastasized. PET/CT with 68Gallium DOTATATE proved to be an effective imaging method not only for the primary diagnosis of NET and subsequent therapeutic behavior, but also for evaluating the effect of the treatment. We present a case of a positive PET/CT scan, performed with Ga-68 DOTATATE in the topical location of the tail of the pancreas after therapy with Sandostain lar. The challenges associated with early diagnosis and monitoring the effects of treatment present a significant issue in the field of nuclear medicine. PET/CT with Ga-68 DOTATATE fully addresses these challenges and paves the way for new developments and the creation of increasingly specific radiopharmaceuticals.

1. (Additional article). „*Restaging role of 18F-FDG-PET/CT in a patient with a Malignant Peripheral Nerve Sheath Tumor (MPNST) caused by neurofibromatosis – case report*"

Malignant Peripheral Nerve Sheath Tumors (MPNST) are a malignant disease that originates in the cells that cover and protect the peripheral nerves. They are a rare disease, accounting for 6% of soft tissue sarcomas. We present a patient with a malignant peripheral nerve sheath tumour on the left brachium with neurofibromatosis. The patient underwent whole body PET/CT for restaging after total extirpation of a tumor formation originated from n. musculocutaneous in 09.2017, an excision of a recurrent tumor formation in the proximal half of the brachium invading into m. biceps brachii in 12.2017, a performed MRI in 02.2018 - with data for multiple MPSNT in the area between the two previous operations - and subsequent definitive radiotherapy (boost) in the area of the tumor formation and 6 cycles of chemotherapy with Epirubicin. After restaging PET/CT scan of the whole body was performed, progression of the disease was defined - increased in size and activity subpleural lesion in the lower lobe of the right lung. Although pulmonary metastases are common in patients with soft tissue sarcomas, the incidence of MPNST dissemination is rare. Therapeutic management in such cases relies entirely on a multidisciplinary team and approach aimed at achieving optimal outcomes. The role of 18F-FDG-PET/CT is indispensable, not only due to its whole-body scanning capability but also because of its high sensitivity and specificity in detecting recurrence and distant metastases.

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