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ABSTRACTS E-BOOK

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INVITED LECTURES

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URBAN AIR POLLUTION ASSOCIATED WITH THE INCIDENCE OF AUTOIMMUNE THYROID DISEASES

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Background: Endocrine disrupting air pollutants such as sulphur dioxide (SO2), carbon monoxide (CO), nitrogen dioxide (NO2), fine particle matter (PM2.5), and ozone (O3) can affect thyroid gland function on the level of synthesis, metabolism, and the action of its hormones.
Objective: The aim of this study was to establish whether increased air pollution could contribute to an increased incidence of autoimmune thyroid diseases (AITD).
Methods: A retrospective analysis was conducted of the medical records of 82000 patients at the University Clinical Centre in Tuzla, Bosnia and Herzegovina. The target group of this study comprised a total of 174 patients from the Lukavac area. Daily data on concentrations of air pollutants were collected from the air quality monitoring station located in Lukavac. The study covered the period from 2015 to 2020.
Results: The results of the monitoring confirmed the presence of air pollutants in concentrations above the permitted limits throughout the entire observed period. Concentrations of PM2.5, SO2, NO2, CO, and O3 were in the range of 1.90-431.40 g/m3, 3.60-620.50 g/m3, 3.40-66.20 g/m3, 48.00-7002.00 g/m3, and 0.70-89.40 g/m3, with means of 64.08 g/m3, 77.48 g/m3, 22.57 g/m3, 1657.15 g/m3, and 31.49 g/m3, respectively. During the six-year period, 174 cases of AITD were registered, of which 150 (86.21%) were women and 24 (13.79%) men. Hashimoto's thyroiditis was found in 33 patients (18.97%), whilst 141 patients (81.03%) were diagnosed with atrophic thyroiditis. The highest total incidence of autoimmune thyroiditis was recorded in 2017, when it reached 99.49, 95% CI.
Conclusion: The effects of chronic exposure to a mixture of air pollutants on the function of the thyroid gland are still not sufficiently well-known, but the numerical tendency towards a higher incidence of AITD in this study, albeit without statistical significance ($p>0.05$), still underlines the need for additional research.

Keywords: autoimmune thyroiditis, air pollutants, endocrine disruptors, incidence

FDG IN COLORECTAL CANCER: BEYOND THE GUIDELINES

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Imaging is vital in the management of patients with colon cancer and the role of FDG PET/CT is continuously expanding the process. The benefits of FDG PET CT are widely recognized by the clinicians and therefore included in guidelines for treatment of colon cancer. High sensitivity and whole-body coverage favour its use for patient selection when potentially surgically curable synchronous or metachronous metastasis are present. FDG PET/CT is next step in resolving follow up dilemma when patients present with elevated CEA but with negative findings cross sectional or endoscopy findings. Furthermore, evaluating equivocal finding on a contrast-enhanced CT or MRI scan has proven to been beneficial. Infrequently, FDG PET CT has been advocated as an alternative imaging method when iodinated and gadolinium contrast are both contraindicated. Additionally, FDG PET/CT has been used in various clinical scenarios and the benefit was evident. In patients with obstructive colorectal cancer preoperative FDG PET/CT is used as a reliable technique for diagnosing synchronous tumors. Early postoperative PET-CT changed the staging and treatment of stage III colorectal cancer patients and has the potential for early detection of curable metastatic disease. Several radiomics analyses have been used for predicting KRAS and MSI mutation, the possibility of early disease recurrence as well as survival. Early results of various research regarding FDG PET/CT in colon cancer patients are promising and update of the guidelines is expected in the future.

RADIONUCLIDE DIAGNOSIS AND THERAPY IN CHILDHOOD NEUROBLASTOMA WITH DIAGNOSTIC SINGLE CENTRE EXPERIENCE

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Neuroblastoma is the most frequent solid extra cranial childhood malignancy, usually affecting children under five. It arises from neural crest cells with neuroendocrine features and is characterized by the overproduction of catecholamines. The clinical presentation of neuroblastoma can vary from spontaneous regression to aggressive growth and death. The latest staging system utilized for neuroblastoma is the International Neuroblastoma Risk Group Staging System (INRGSS), which relies on preoperative imaging and image-defined risk factors.

Radiopharmaceuticals of interest in the evaluation of neuroblastoma are [$^{123/124/131}$ I] I mIBG, [^{18}F] FDOPA, [^{68}Ga] DOTA peptides, [^{18}F] FDG. The efficacy of each radiopharmaceutical is determined by distinct neuroendocrine cell uptake mechanisms. The cornerstone of neuroblastoma diagnosis is mIBG scintigraphy, which facilitates both PET imaging and therapy.

Neuroblastoma cells also overexpress somatostatin receptors, thus the peptide receptor theranostic concept may be employed in treatment. Scintigrams obtained through mIBG are semi-quantified by either the Curie or the International Society of Paediatric Oncology Europe Neuroblastoma (SIOPEN) scoring systems. As Serbia is a member of SIOPEN (SERPHO Serbian Society for Paediatric Hemato-Oncology), the SIOPEN semi-quantitative scoring system is used rather than Curie system for mIBG scintigram evaluation.

The Centre for Nuclear Medicine with PET of UCCS reintroduced mIBG scans in neuroblastoma patient evaluation in 2007. Since then, 190 children with neuroblastoma have been diagnosed, and over 350 scintigrams were semi-quantified by SIOPEN score, both soft tissue and bone score.

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BRAIN SPECT PERFUSION IN DIAGNOSIS OF ATYPICAL FOCAL VARIANTS OF ALZHEIMER DEMENTIA

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Introduction: Posterior cortical atrophy (PCA), is a rare form of dementia, considered as atypical variant of Alzheimer dementia (AD). Our objective was to evaluate the brain SPECT perfusion scan usefulness in diagnosis of atypical variants of AD.
Material and methods: We include 22 patients diagnosed with AD according to the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association criteria and liquor biomarkers. 99mTc-HMPAO Brain SPECT was performed according to EANM procedure guideline, software evaluation, based on voxel by voxel analysis in common stereotactic space with NeuroGam software and comparison with age-matched database of normal scans and representation by BA. Pearson correlation coefficient was applied to evaluate correlation between MMSE and extent of hypoperfusion expressed in number of statistically significant hypoperfused BA regions.
Results: In 7/22 patients according clinical criteria and liquor biomarkers PCA was diagnosed, 5 with significant hypoperfusion in occipital lobe. In the remaining 15 AD patients only one had occipital lobe hypoperfusion. The distribution pattern revealed that the most affected areas in the AD group were parietal, temporal, and posterior cingulate gyrus, but in the PCA patients also hypoperfusion in BA17 and 18, 19, corresponding to occipital involvement, was found. We found negative weak non-significant correlation between MMSE and extent of hypoperfusion (Pearson r = -2.72; p=0.274; significant for $p<0.05$).
Conclusion: Even though a marker for neurodegeneration, brain SPECT can be of a diagnostic value especially in differentiating atypical variants of AD, like PCA in a lack of unaffordable, expensive AD imaging biomarkers.

Keywords: Brain SPECT, 99mTc-HMPAO, Posterior cortical atrophy, Neurodegenerative dementia

NEUROISCHEMIC DIABETIC FOOT – DETECTION OF PERIPHERAL ARTERIAL DISEASE AND THE RISK OF AMPUTATION

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The diabetic foot is a chronic complication of diabetes mellitus where symptoms and signs of neuropathy, ischemia and deformities interfere, that can lead to ulceration, infection and/or amputation. Loss of protective sensitivity (LOPS) and peripheral arterial disease (PAD) usually present simultaneously (neuroischemia), therefore are associated with a higher risk of ulceration of the diabetic foot. PAD further poses a risk of slow healing of a wound, as well as an infection and/or amputation. The ankle pressure measurement and ankle-brachial index (ABI) are weak predictors of healing. Low ankle pressure (e.g. <50 mmHg) or ABI (e.g. <0.5) may be associated with a higher likelihood of impaired healing and a higher likelihood of major amputation. In the event of ulceration/re-ulceration, it is mandatory to assess ischemia and infection (WiFi) that determines the prognosis for wound healing. Above all, if there is an indication, an assessment of perfusion is performed as well as the evaluation of the revascularization benefit. In terms of amputation risk, the likelihood of major amputation increases by approximately 45% with ABI <0.4 while ABI 0.9–1.3 is not associated with an increase in risk. Studies have shown that ABI > 1.3 is also associated with an increased risk of ulceration.

DELON DECOMPRESSION OF THE TARSAL TUNNEL: AN EFFECTIVE APPROACH TO IMPROVING BLOOD FLOW AND PROMOTING ULCER HEALING IN DIABETIC PATIENTS

Sofija Pejkova[1], Gordana Georgieva[1], Savetka Paljoshkovska Jordanova[2], Tanja Makazlieva[3], Sinisa Stojanovski[3], Stefania Azmanova Mladenovska [1] , Katerina Jovanovska [1] , Blagoja Srbov [1] , Sofija Tusheva [1] , Nevena Manevska[3]

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In our study, we hypothesized that improving sympathetic nerve function through tibial nerve decompression would lead to enhanced blood flow, improved sensibility of plantar area, and reduced ulcer healing time in patients with diabetic neuropathy.
This prospective study included 20 patients with non-healing diabetic neuropathic ulcers, presenting for mean of 17.1 months. Inclusion criteria included good glycemic control and positive Tinel sign at Tarsal tunnel. Pre-operatively, sensory symptoms were evaluated with the Michigan Neuropathy Screening Instrument (MNSI), and blood flow was assessed by Doppler ultrasonography. Ulcer characteristics were analyzed using DMIST scale. "Dellon Decompression" of the four medial ankle tunnels was performed.
Neuropathy symptoms, evaluated by MNSI, decrease at 9-month follow-up from mean of 11.85 pre-operatively to 5.15 ($p<0.001$). There was significant improvement of sensory function of medial, lateral plantar and calcanear nerves in the operative vs. control foot of same patients by TPD-MRC ($p<0.001$). Doppler ultrasonography revealed significant improvement in blood flow within posterior tibial artery, increasing from 1.72 to 5.34 cm^3/sec at 9 month follow up ($p<0.0001$). At the 9-month follow-up, 55% of patients had completely healed ulcers, while in 45% there was 83.25% reduction in ulcer size, which was in correlation with DMIST score.
In conclusion, decompression of sympathetic fibers within tibial nerve at ankle can enhance blood flow in diabetic neuropathy. Dellon Decompression of four medial ankle tunnels also improves wound healing in foot's plantar area and emphasizes crucial role of enhanced blood flow and sensibility in promoting ulcer healing in diabetic foot patients.

PET RADIOPHARMACEUTICALS IN ONCOLOGY: CURRENT STATUS AND PERSPECTIVES

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Molecular imaging is the visual representation of in vivo biological processes that take place at the cellular or molecular level. Among all imaging modalities, positron emission tomography (PET) is one of the important clinical molecular imaging techniques used in oncology. Beyond ^{18}F-FDG, the most widely used PET radiopharmaceuticals for oncological applications, several tracers have been developed to target specific tumor-related processes such as increased metabolic pathways, over-expression of receptor proteins and tumor hypoxia and to overcome the limitations of ^{18}F-FDG. Some of these tracers are currently used in clinical practice founding important applications also in the field of theranostics, where molecular imaging and targeted therapy are integrated for improving patient disease diagnosis, monitoring and treatment. Besides these, oncoming oncological PET tracers directed to new targets, such as tumor microenvironment, are promising for diagnostic clinical use, paving the way for further theranostic developments and thereby expanding applications for targeted personalized therapy.

ADDED VALUE OF CORONARY ARTERY CALCIUM SCORE TO SPECT MYOCARDIAL PERFUSION IMAGING IN EVALUATION OF CORONARY ARTERY DISEASE SIGNIFICANS

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Background: The diagnostic assessment in suspected atherosclerotic obstructive coronary artery disease (CAD) remains a persistent challenge. A critical objective is to estimate the risks of coronary events and mortality with accurate diagnostic tests.
Objective: SPECT MPI is well established noninvasive functional test with high accuracy, specificity, and positive predictive value. Through analyzing of flow-dependent uptake of a radiopharmaceutical by the functional myocardium ischemia could be clearly detected. Symptomatic patients with mild to moderate perfusion defect often require coronary intervention, but in several studies only 50% of abnormal diagnostic coronary angiographies are followed by revascularization. Also in a case of balanced ischemia, additional information could help. Coronary artery calcium (CACs) could be useful in prediction of atherosclerotic burden and the likelihood of future cardiac events. Several studies confirm added value of CACs to nuclear image, especially very high value. SPECT /CT MPI as a hybrid nuclear imaging technique enables collecting calcium score data as additional prognostic information to myocardial perfusion and LV functional analyses to boost their diagnostic accuracy Throw several cases from our everyday practice we will show the added value of CACs to perfusion image in risk classification of patients with suspected CAD.

Conclusion: CACs may offer added diagnostic information over MPI for identifying patients with significant CAD. Future studies will determine whether a strategy of applying CAC scanning to symptomatic patients with a low-to-intermediate likelihood of CAD, followed by nuclear imiging represents a cost-effective strategy for managing patients.

Keywords: SPECT /CT MPI, CACs

USE OF ^{99M}TC-PYP IMAGING IN CARDIAC AMYLOIDOSIS: OUR EXPERIENCE

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BACKGROUND: Amyloidosis is a rare disease characterized by excessive production and tissue deposition of various abnormal proteins. One or multiple organs can be affected with different clinical scenarios. Cardiac amyloidosis has unfavorable outcome due to the occurrence of restrictive cardiomyopathy and congestive heart failure. Significant cardiac involvement is found most often in transthyretin amyloidosis (ATTR) and light-chain amyloidosis (AL). Hereditary ATTR is caused by different gene mutations for transthyretin protein that turns normally soluble form into misfolded forms which are deposited in myocardium and other organs leading to subsequent structural and functional changes. In wild type ATTR spontaneous deposition of transthyretin occurs in older people without gene mutation. Light-chain immunoglobulines constitute the pathological substrate of deposited fibrils in AL amyloidosis, that has much worse prognosis compared to ATTR.
METHODS: The role of echocardiography as primary imaging modality has been well established. Cardiac magnetic resonance imaging (CMR) has also been successfully implemented in clarifying the underlying cause of unexplained heart failure symptoms. The problem with both echocardiography and CMR is that they could not differentiate the type of cardiac amyloidosis. Nuclear imaging could be successfully implemented in the diagnosis of early cardiac amylodiosis, differentiating ATTR cardiac amyloidosis from other subtypes and monitoring patients over time. Most widely used today are two bone-seeking phosphate derivatives labeled with ^{99m}Tc: ^{99m}Tc-DPD and ^{99m}Tc-PYP. We present our experience with ^{99m}Tc-PYP in patients with ATTR cardiac amyloidosis. ^{99m}Tc-PYP scintigraphy with both planar and SPECT imaging at one and two hours post injection was performed. Semi-quantitative visual Perugini score as well as quantitative analysis by drawing region of interest over heart and corrected for contralateral counts to calculate heart-to-contralateral ratio (H/CL) was done.
RESULTS: ^{99m}Tc-PYP scintigraphy has shown very good results in imaging hereditary ATTR cardiac amyloidosis. We performed PYP scan in total of 43 patients and 29 of them were positive. Visual scan analysis, visual semi-quantitative score and quantitative analysis showed intense myocardial tracer uptake in positive patients and in all ATTR amyloidosis was confirmed by means of genetic testing. In 14 patients with suspicion of wild type ATTR on echocardiography PYP scan was either negative (12 patients) or equivocal (2 patients).
CONCLUSIONS: Multidisciplinary team work is essential in the recognition of cardiac amyloidosis. ^{99m}Tc-PYP scintigraphy presents simple, readily available and accurate nuclear method for both diagnosis and confirmation of ATTR subtype of cardiac amyloidosis. It is an important complementary imaging modality to echocardiography and MRI in the complete workup of the patients.

SPECT MYOCARDIAL ISCHEMIA AND VIABILITY IMAGING IN THE ERA OF CURRENT OPTIMAL MEDICAL THERAPY

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Although major advances have occurred lately in medical therapy, ischemic heart failure remains an important cause of death and disability. Viable myocardium represents a cause of reversible ischemic left ventricular dysfunction. Coronary revascularization may improve left ventricular function and prognosis in patients with viable myocardium. Although patients with impaired left ventricular function and multi-vessel coronary artery disease benefit the most from revascularization, they are at high risk of complications related to revascularization procedure. Multiple imaging modalities can assess myocardial viability and predict functional improvement after revascularization, with dobutamine stress echocardiography, nuclear imaging tests and magnetic resonance imaging being the most frequently used. However, the role of myocardial viability testing in the management of patients with ischemic heart failure is still controversial due to the failure of randomized controlled trials of revascularization to reveal clear benefits of viability testing. The presentation summarizes the current role of SPECT imaging in detection of viable and ischemic myocardium, and their role in the era of modern medical therapy. It also discusses the research involving this topic and the controversies related to the utility of myocardial viability testing and provides a patient-centered approach for clinical practice.

Keywords: viability, ischemia, SPECT imaging, risk stratification

ONCOLOGY SYSTEMIC THERAPY AND PERSONALISED MEDICINE IN MANAGEMENT OF ADVANCED/METASTAIC THYROID CANCER

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As a most common endocrine malignancy, thyroid cancer responds well to conventional therapy: surgery, radioactive iodine therapy and suppression of thyroid-stimulating hormone. Oncology systemic therapy can be considered for thyroid cancers that are not amenable to other local therapies and have clinically significant disease progression during the last 6 to 12 months.
Treatment management of advanced or metastatic thyroid cancer should be based on multiple factors: symptoms, performance status of the patients, location of lesions, tumor burden and disease progression.
Personalized medicine in advanced/metastatic thyroid cancer includes genomic testing to identify potentially actionable mutations: ALK, NTRK, BRAF, and RET gene fusions; DNA mismatch repair deficiency (dMMR); microsatellite instability (MSI); tumor mutational burden (TMB). Traditional systemic chemotherapy, has minimal efficacy in patients with metastatic differentiated thyroid cancer. Novel treatments for patients with metastatic differentiated thyroid carcinoma include multitargeted kinase inhibitors (MKI). The MKIs block signaling from the tyrosine kinase receptors, thus preventing phosphorylation and, ultimately, angiogenesis and tumor growth.
Immunotherapy is novel treatment with promising antitumor activity in advanced/metastatic papillary, follicular and anaplastic thyroid carcinoma which progressed on standard therapies.
In conclusion, MKIs still show promising results in the treatment of advanced/metastatic thyroid cancer and immunotherapy represents a new era that still needs to be investigated.

THE PROGNOSTIC SIGNIFICANCE OF BRAFV600E MUTATION IN PAPILLARY THYROID CARCINOMA

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Introduction: The BRAFV600E mutation is the most frequent genetic alteration, but still is not routinely recommended in the initial evaluation of the papillary thyroid carcinoma (PTC). The aim of our study was to evaluate the impact of the BRAFV600E mutational status on the outcome of PTC patients followed more than 5 years.
Material and methods: Fifty-four patients were evaluated for BRAFV600E mutational status from the primary tumor tissue. Patients were classified according to their therapy response in three categories: complete responders to treatment, biochemical incomplete responders and patients with structural persisting disease. We perform Chi-square test to analyze weather there is statistical significance in frequency distribution of different therapy responses according BRAFV600E mutational status.
Results: 35/54 (64.8%) were BRAFV600E + PTC patients and 19/54 (35.2%) were BRAFV600E -. In BRAFV600 + PTC patients, 26/35 (74.3%) were complete responders, 6/35 (17.1%) were with biochemical incomplete response and 3/35 (8.6%) were with persisting disease. Statistical analysis didn't reveal significant difference in frequency distribution of complete and incomplete responders between the two group of PTC patients regarding BRAFV600 mutational status **(Chi-square= 0.941954887, df=2, p=0.62).**
Conclusion: No significant difference was found in age at diagnosis and initial staging among BRAFV600E + and – groups. Our analysis and follow-up didn't reveal difference in prognosis between the two groups according BRAF mutational status. Limitation of the study was small group of patients, further analysis of larger group of patients is recommended to discover the true meaning of BRAFV600E in the prognostication.

Keywords: Papillary thyroid carcinoma; BRAFV600E, prognosis.

CHALLENGES IN DEVELOPING FIRST LABORATORY FOR THERANOSTIC IN BOSNIA AND HERZEGOVINA

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The theranostic concept in nuclear medicine refers to the use of different isotopes for labeling the same ligand specific to the same target. Labeling of the ligand with radionuclide pairs for both diagnosis and treatment should be performed in specialized facilities called theranostic laboratories. The incidence of non-communicable diseases (NCDs) in Balkan countries is escalating, so the development of these laboratories has become increasingly popular. The first challenge in the implementation of this concept is to ensure adequate reimbursement from the national health insurance funds for medical procedures. The shortage of trained personnel in radiopharmacy is a widespread problem in developing countries. It necessitates the introduction of postgraduate educational programs/specialization in the home country or sending the professionals to foreign countries, which have sufficient infrastructure for training, education, and fellowship programs in theranostic practice. Collaboration with European or international organizations and collaborative work with experts in the field can be very helpful in organizing education. Import of radionuclides, precursors, cassettes, generators, and equipment from distant countries also represents a logistic challenge. Moreover, the lack of official technical service representatives makes more expensive the installation, qualification, and maintenance of the equipment. A non-negligible expense is the adaptation of the rooms where the isolators/laminar-flow chambers will be installed and synthesis and quality control of radiopharmaceuticals will be done. In order to improve patient management and to have better outcomes in the treatment of NCDs, some Balkan countries have already found a way to overcome all previously mentioned obstacles.

IMMUNE CHECK POINT INHIBITORS AND THYROID DISORDERS

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BACKGROUND: Immune check point inhibitors (ICI) are new class of drugs nowadays widely used in the treatment of various types of cancer with good results. By enhancing the response of the immune system, they add to the destruction of malignant cells, but also promote autoimmunity. In this new category of adverse reactions, known as immune related adverse events (irAEs), immune endocrinopathies and especially thyroid disorders are very common. Thyroid dysfunction can be manifested either as hyperthyroidism, followed by hypothyroidism, or as de novo hypothyroidism. In ICI treated patients hyperthyroidism is reported in 1-10%, while hypothyroidism ranges between 1-15%. The pathogenesis of irAEs is not yet clearly understood, although various mechanisms have been proposed.

METHODS: we present a case of 31-year-old man who was referred to our department for evaluation of abnormal thyroid function tests two months after the start of immunotherapy with pembrolizumab. He underwent surgical treatment for malignant melanoma, initially located at the back, with left axillar lymph node dissection. The patient was in stage IIIB and BRAF positive and PD-L1 negative. As part of surveillance for irAEs, thyroid function tests were regularly checked. He had no family history for thyroid diseases.

RESULTS: at initial presentation he was clinically euthyroid with TSH=0.01 mIU/L (normal, 0.4-4.5 mIU/L), FT4=24.2 pmol/L (normal, 11-15 pmol/L), FT3=6.2 pmol/L (normal, 2.8-6.5 pmol/L), a-TPO<10 kIU/L (normal, <35 kIU/L), a-TG<20 kIU/L (normal, <40 kIU/L) and TRAb=1.01 UI/L (normal, <1.5 UI/L). Thyroid ultrasound was unremarkable and thyroid pertechnetate scan showed normal position, shape and size of the gland, with slightly decreased uptake in both thyroid lobes. He was put on observation and at the next check-up one month later his thyroid function tests were consistent with sublinical hypothyroidism (TSH=9.2 mIU/L, FT4=14.3 pmol/L and FT3=4.2 pmol/L). Therapy with l-thyroxin was not initiated as he was still clinically euthyroid. However, one month later his TSH rose first to 30 mIU/L, and then to >100 IU/L. He started to complain on chest discomfort and subsequent cardiological examination excluded any cardiac dysfunction. The patient was put on substitution therapy with l-thyroxin with gradual increase of the dose up to 125 g in order to achieve euthyroid state.

CONCLUSIONS: patients with cancer treated with ICI should be regularly checked for irAEs. Thyroid disorders are among the most frequent immune endocrinopathies and can have different clinical phenotypes that need to be recognized and treated properly. Unfortunately, endocrine disorders induced by ICI are usually irreversible and lifelong follow-up of the patients is needed.

^{99m}Tc-MIBI TISSUE MUSCLE PERFSUION SCINTIGRAPHY OF LOWER LIMBS AND FEET IN DIABETIC PATIENTS

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Tissue muscle perfusion scintigraphy with ^{99m}Tc-MIBI (99m Technetium- methoxyisobutylisonitrile) is a diagnostic technique that shows promising results in the early detection of impaired tissue perfusion in patients with diabetes, particularly beneficial for identifying "at-risk" patients, without clinical symptoms. The early diagnosis of peripheral artery disease (PAD) is important considering the fact that PAD may remain asymptomatic in 50% of diabetic patients. Patients with both PAD and diabetes face serious complications, frequent hospitalizations and need for revascularization, and deteriorate quality of life.

This method can be performed in two phases “rest” – baseline perfusion and “stress” – after exercise (foot flexion and extension). The advantages of this non-invasive method are manifold. It can identify subtle changes that may not be apparent through clinical examination alone, thus eliminating the need for more invasive procedures and providing quantitative data about tissue perfusion as calculating the perfusion reserve.

Most patients with PAD also have concomitant coronary arterial or artery disease (CAD), which lead to a 20% increase in the risks of nonfatal myocardial infarction and cerebrovascular stroke, as well as an increased mortality rate in 30% of such patients. Furthermore, together with the myocardial perfusion scintigraphy this method enables one day protocol for evaluating and quantifying both myocardial and peripheral perfusion.

Nonetheless, even in the group of diabetic foot ulcer patients, this method can predict the reversibility of the microvascular changes of foot perfusion following surgical intervention, such as tarsal tunnel decompression, along with ulcer healing, providing thus a better quality of life.

IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM IN HEALTHCARE INSTITUTION FOR THE PRODUCTION OF RADIOPHARMACEUTICALS AND NUCLEAR MEDICINE PRACTICE

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Quality management system has become an important issue for healthcare institution over the last decades. The adoption of a quality management system (QMS) is a strategic decision for all organizations especially for our healthcare institution due to the multidisciplinary activities in production of radiopharmaceuticals and nuclear medicine practice. Specifically, the quality management system includes international standards of Quality management systems - Requirements (ISO 9001:2015), the principle of the pharmaceutical quality system - Good Manufacturing Practice (GMP) requirements and comprehensive program QUANUM (Quality Management Audits in Nuclear Medicine) developed by International Atomic Energy Agency (IAEA). All are interlinked with each other as they all focus on ensuring product quality, safety, and nuclear medicine efficiency in different ways.

Our goal was to find an appropriate approach and to integrate all of these parts in interrelated processes that function as a coherent QMS system. We used process-oriented approach as a management strategy which incorporates the plan-do-check-act cycle and risk-based thinking in production of radioisotopes and radiopharmaceuticals department, nuclear medicine department, general and radiation safety and administrative sector. The quality management implementation comprised training, methodological assistance, continuous communication with external organization - Macedonian organization for certification and assessment, continuous communication between quality manager and the staff, and analysis of the written documents produced by all the departments.

In healthcare institution for the production of radiopharmaceuticals and nuclear medicine practice quality management can be greatly improved through the right quality management strategy. Successful implementation and continual improvement of process performance and product quality requires active participation of all parties involved in the processes, management review and leadership.

RISK MANAGEMENT: A NEW PERSPECTIVE IN THE IAEA QUALITY MANAGEMENT PROGRAM

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Introduction: Risk Management is a systematic application of management policies, procedures, and practices to the tasks of analyzing, evaluating, controlling and monitoring risk. Implementing a risk management strategy helps to effectively identify and mitigate risks..

Materials & Methods: It is more and more increasing the understanding of the relevance of a "prospective model" of Quality Management, aimed to study "a priori" new techniques and methods in order to design a safe clinical workflow for patients, and a safer workplace for staff, in advance. The adoption of prospective methodologies, such as widely used Failure Modes and Effects Analysis (FMEA), even in a qualitative or semi-quantitative mode, can allow for a more robust set of SOPs, and for a system of controls, including QA/QC procedures, that are graduated according the risk and taylored to the real needs.

Results: The IAEA formed a QUANUM advisory committee, that discussed future strategies and prepared a basic model of FMEA spreadsheets. Several examples were prepared, including scenarios like: injection of ^{99m}Tc radiopharmaceuticals, injection of ^{18}F-FDG, therapy of thyroid cancer with ^{131}I capsules, labeling of kits with ^{68}Ga, and others.

Conclusions: The IAEA is promoting the practice of risk management in Nuclear Medicine and, in general, in diagnostic imaging. Tools, like an FMEA basic spreadsheet and a library of examples will shortly be available at the IAEA's Human Health Campus, that can be easily adapted according to local situation. This further extension to the QUANUM portfolio will help improve quality and safety in delivering patient care.

Y-90 MICROSPHERE TREATMENT: NOVEL APPLICATIONS

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Y-90 microsphere treatment also known as transarterial radioembolization (TARE) serves as an efficient and safe therapy option for both primary and metastatic liver tumors, which are unresectable. The theoritical basis of this treatment depends on the fact that liver tumors are fed on hepatic artery while portal vein is the main vascular supply for healthy liver tissue and that tumor cells can be selectively targeted via transarterial route. Based on this principle, TARE provides high radiation dose to tumor cells while healthy hepatocytes can be spared to a great extent from hazardous effects of high dose radiation. The main difference of TARE from other interventional embolizing therapies such as chemoembolization (TACE) is that embolization just functions as a lodging mechanism of Y-90 loaded microspheres to the capillary ends within tumor tissue and therefore ischaemia is not induced, contrary to TACE. The first applications of TARE were primarily for palliative intent where this treatment was only given for patients with advanced disease, mostly as salvage fashion. Along with emerging novel dosimetric methods, TARE can currently be applied with also for curative intent, such as radiation segmentectomy, lobectomy and modified lobectomy applications. Not only advances in dosimetric methods but also in imaging technology such as cone-beam CT as well as SPECT/CT technology present as major keystones which enable such novel applications in daily practice. TARE can also be preferred as a bridging treatment for surgery or liver transplantion, both of which also serve for curative intent. Owing to such novel applications, it is currently possible to increase the tumor radiation dose to much higher levels along with providing optimal doses for non-tumoral liver tissue and the lungs. There are increasing number of clinical studies which demontrate solid benefits of using such novel techniques with regard to better treatment outcomes and lower side effects and complications. These improvements definitely enable Y-90 microsphere treatment to be placed in treatment algorhtyms in established multidisciplinary guidelines and expert reports.

MOLECULAR IMAGING IN CARCINOMA OF UNKNOWN PRIMARY

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Carcinoma of Unknown Primary (CUP) is one of the 10 most frequent group of cancers worldwide. CUP is a heterogeneous group of pathology in which metastatic cancer cells are detected, but the primary site of origin of the cancer is unknown despite of complete and extensive evaluation.
Current data suggest that metastatic dissemination can actually occur in the absence of growth of primary. Chromosomal instability was recently incriminated as an important factor for chemoresistance and poor outcome.
PET-CT with 18F-FDG can help identify the primary site of the cancer by detecting the hypermetabolic activity of the cancer cells, but also helps in demonstrating extent of disease.
It is generally accepted that FDG PET-CT detectability rate of primary tumor is more than 30% (range ~30-80%) vs. CT/MRI & random biopsy, which have a detectability rate of no more than 10-20%.
Other tracers may be used in certain situations, such as Gallium-68 DOTATATE or ^{18}F-DOPA for neuroendocrine tumors.
More recent FAPI-PET (Fibroblast Activation Protein Inhibitor-PET) has emerged as a newer imaging modality that has shown promise in the evaluation of Carcinoma of Unknown Primary (CUP).
FAPI is a small molecule inhibitor that binds to fibroblast activation protein, which is overexpressed in many types of cancer cells. FAPI-PET imaging can help detect the presence and location of cancer cells, including those in CUP, with high sensitivity and specificity.
In this paper we`ll present a review of most relevant papers and guidelines related to the CUP management.

ORAL PRESENTATION

May 30 to June 02, 2024
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BCNM-24/001

EXPLORING INTERMEDIATE ENERGY CYCLOTRON-BASED PROTON IRRADIATION FOR RADIONUCLIDE PRODUCTION IN MEDICAL APPLICATIONS

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Radioactivity plays a crucial role in medical practices, particularly in diagnosis and radiotherapy, where the effectiveness relies heavily on selecting appropriate radionuclides [1]. The decay properties of a radionuclide are key in determining its suitability for specific medical uses. Equally important are the production conditions, which determine the feasibility of obtaining the radionuclide in both high purity and sufficient quantities.

While both nuclear reactors and cyclotrons are utilized for radionuclide production, there has been a noticeable preference for cyclotrons/accelerators in recent years. In the last three decades, extensive experimental research has focused on using accelerators to produce radionuclides, covering energies up to approximately 30 MeV [2]. The database of cross-sections for nuclear reactions induced by charged particles up to 30 MeV is comprehensive, with theoretical models showing significant success in describing reactions at low energies.

Protons with energies up to about 70 MeV are commonly employed in producing various widely-used radionuclides. There is growing interest in using intermediateenergy protons for producing many other radionuclides. However, the existing crosssection database in this energy range remains relatively limited, with nuclear model predictions achieving only partial success in characterizing available data [3].

In this investigation, we explore the production of specific non-standard positron emitters using proton beams up to 60 MeV. We specifically examine the nuclear reactions of natGe(p,x)68Ge→68Ga (with a half-life of 1.1 hours), natGe(p,x)69Ge (witha half-life of 39.05 hours), and natPr(p,x)140Nd (with a half-life of 3.37 days), offering detailed experimental procedures, analyses of their properties, and potential applications.

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BCNM-24/002

EXAMINING THE CELLULAR CHARACTERISTICS OF TUMOR CELL CULTURES USING RADIOACTIVE LABELED SASSAY IN COMPARISON TO OTHER ASSAYS WITHOUT THE USE OF RADIOACTIVITY

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Recently, there is a trend to replace many reactive tests for cellular analysis in medicine and biology, including the investigation of the function of cellular immunity, with other tests in order to reduce the professional radiation exposure of personnel working in laboratories and medical institutions. For more functional cell proliferation, the test with 3H thymidine has been widely used until now, while 51 Chromium (Cr) release assays have been used to test cellular cytotoxicity, especially for determination the function of NK cells and cytotoxic lymphocytes. In this work, Raji tumor cells incubated in-vitro in the presence of different concentrations of TNF-alpha were used in order to examine its effect on the degree of induction of cell death or proliferation depending on the concentration and incubation time. In parallel, under the same experimental conditions, other enzymatic methods or methods of protein detection based on change in absorbance were used. The principle of enzyme methods is to determine changes in the LDH enzymes that the cells possess after the addition of the substrate in the cells or the supernatant of cell cultures. The colorimetric MTT test was also used. 51Chromium (Cr) release assays were used to examine the cell death of erythroleukemia K-562 and MDS cells as target cells in the NK test for funcional activity. The results showed that there is a correlation between the tests carried out, but standardization is necessary because various methods can be used to measure changes at different intracellular levels. Each of the examined tests shows advantages and disadvantages, but therefore a precise interpretation of the obtained findings is needed, especially in co-cultures of mixed cells where there are both healthy and tumor cells, such as the NK asay for testing immunity. In order to reduce the effect of radiation in laboratory medicine and reduce the risk of people working with the radiation source, new methods are recommended that do not use radioactive isotopes wherever possible, but with standardization and certain mathematical correlations.

BCNM-24/003

THE PREDICTIVE ROLE OF TMTV AND TLG IN FIRST-LINE TREATMENT RESPONSE IN DLBCL PATIENTS

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Introduction: Diffuse large B-cell lymphoma (DLBCL) presents treatment challenges with high relapse rates. Total metabolic tumor volume (tMTV) and total lesion glycolysis (TLG) from 18F-FDG PET/CT scans hold potential as prognostic indicators, but standardized calculation methods and validation across diverse patient groups are necessary for clinical utility.
Aims: To quantify tMTV in pre-treatment patients with DLBCL and assess its value together with TLG as a potential predictor of treatment response.
Materials and methods: A retrospective analysis of 40 DLBCL patients with baseline and end-of-treatment (EOT) ^{18}F-FDG PET/CT scans was conducted. Patients received immunochemotherapy with anti-CD20 antibody and tMTV and TLG were calculated using Syngo.via software with a tumor threshold of 1.5 times the mean SUV of the liver +2 standard deviations. EOT scans were assessed for treatment response based on Lugano criteria.
Results: The mean age of the patients was 56 years (22-85 years). The mean MTV for responders was 498.40 cm3 (range 1.79 - 3244.02), compared to 591.96 cm3 for non-responders (range 37.74 - 1080.87) while TLG values were 4427.07 (range 7.88 - 37213.10) and 6391.50 (range 643.16 - 13346.80), respectively. Mann-Whitney U tests showed no statistical significance between MTV (p=0.102) and TLG values (p=0.051) for responders and non-responders.
Conclusion: Our study suggests that MTV and TLG may not reliably predict treatment response in DLBCL patients. Further investigation with larger sample sizes in both responder and non-responder groups is needed to determine the true predictive value of these parameters.

BCNM-24/004

THE EFFECT OF SELECTING THE SHAPE OF THE REGION OF INTEREST IN STATIC KIDNEY SCINTIGRAPHY ON THE DETERMINATION OF SPLIT RENAL FUNCTION

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Introduction/Aim: European Association of Nuclear Medicine (EANM) in it's 2020 Guide suggests that region of interest (ROI) should be drawn tightly around the kidneys in order to determine split renal function (SRF). This process tends to be time consuming and with limitations in available commercial software even more so, when adjusting position, selecting background and overcoming non-existance of surface area normalization. Aim of this study was to determine effects of different ROIs on value of SRF.

Method: Static kidney scintigraphy was performed in 102 patients using 99mTc-DMSA(di-mercapto-succinic acid). First, ROI was set tightly around the larger kidney, in order to replicate and fit it around the contralateral kidney. Same ROI was used to determine the value of background. SRF was than calculated by two observers. Other than recommended method, ROIs in shape of ellipse and rectangle were used.

Results: SRFs calculated by two observers had no significant differences. Bland-Altman plot showed that when compared to Guide suggested method, ellipse and rectangle shaped ROIs resulted in SRF values that were within agreed limits, for SRF values of 30%-70%. Outside of this range, percentage of values with higher error was considerable, with the highest errors for SRF<15%.

Conclusion: Using rectangle ROI is justified when SRF is greater than 30%. For ellipse ROI this is the case in even greater extent. For lower SRF values, difference to recommended method tends to become unacceptably high, so in these cases approximations in order to save time and simplify process should not be made.

BCNM-24/005

STOMACH WALL METASTASIS FROM PRIMARY BREAST CANCER

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INTRODUCTION Metastatic breast cancer is systemic disease and it has poor prognosis. Most common metastatic sites from breast cancer are bones (60-75%), liver, lungs and brain depending on the type of cancer. Less common breast cancer metastasis is found in lymph nodes, adrenal glands and the skin, but stomach metastasis are very rare (0,1-6%). Histopathological correlation is obligatory, so can be distinguished from primary gastric carcinoma.

CASE REPORT We present a case of 51-year-old woman diagnosed with breast cancer in 2019. Radical mastectomy was performed, followed by chemo and radiotherapy. On follow up PET/CT in 2022 increased metabolic activity (SUVmax=4.6) in the gastric wall was detected, suspicious for gastritis and bone metastasis were detected. Because of preexisting dyspeptic symptoms and PET/CT findings, gastroscopy was performed and there was hyperplastic zone found in the region of the lesser curvature of the stomach, followed by biopsy. Histopathology report revealed metastasis of primary breast cancer and chemotherapy was initiated. Next PET/CT in 2023 showed metabolic progression in the stomach and new metabolically active lymph nodes, suspicious for metastasis along the lesser curvature. Then the patient started another chemotherapy treatment.

CONCLUSION Breast cancer metastasis to stomach wall are very unusual and can present with nonspecific symptoms. PET/CT findings directed the oncologist towards gastroscopy, followed by histopathology and immunohistochemistry, which is crucial in differentiating this type of metastasis from primary gastric cancer and having the correct treatment plan.

BCNM-24/006

^{99m}Tc-DPD AND ^{99m}Tc-PYP SPECT/CT SCINTIGRAPHY IN THE DIAGNOSIS OF ATTR CARDIAC AMYLOIDOSIS IN EVERYDAY PRACTICE

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The aim of our study was to evaluate ^{99m}Tc-PYP and ^{99m}Tc-DPD scintigraphy as an easy and accurate diagnostic tool for patients with heart failure and preserved ejection fractio n(HFpEF) suspected of having TTR-cardiac amyloidosis (Attr-CM).
Since 2019, a total of 84patients with HFpEF were examined. They had LVEF>50%, elevated proBNP levels, low ECG dynamics and an ultrasound image showing reduction in the longitudinal strain of the basal wall segments with normal strain levels in the apical segments (apical-sparing).Imaging was performed with a GE-Infinia-II Dual-Headed γ -camera and since September 2023, a Mediso-AnyScan SPECT/CT dual-headed γ -camera.Images, planar and SPECT (53patients) or SPECT/CT (31patients) were obtained at one hour and at three hours post radiopharmaceutical administration. Myocardial uptake was assessed with Perugini semiquantitative Grading Scale from all images.
Seven(7) patients were positive for Attr-CM, 51 patients were negative and 26 had an ambiguous result (the last before SPECT/CT). In patients with positive findings for TTR amyloidosis, a genetic test was sent and Val-30-Met mutation was detected. Fifteen patients with Grades 3 and 2, started therapy.
Scintigraphic imaging of the heart may help in the differential diagnosis of AttrCM from other causes of cardiomyopathy. It is a noninvasive examination that can be performed in all departments of Nuclear Medicine and assist in daily clinical practice. If SPECT/CT is performed, the ambiguous results are practically eliminated.

BCNM-24/007

SURGIGAL MANAGEMENT OF NECK METASTASES IN WELL-DIFFERENTIATED AND MEDULLARY THYROID CARCINOMA

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Thyroid cancer metastases to the central and lateral compartments of the neck frequently and early. The impact of nodal metastases on outcome is affected by the histological subtype of the primary tumor and the patient's age, as well as the size, number and location of those metastases. Increased availability of advanced imaging modalities has led to an increased detection rate of previously occult nodal disease in thyroid cancer. The impact of extra nodal extension has recently been highlighted as an important prognosticating factor. Although clinically evident nodal disease in the lateral neck compartments has a significant impact on both survival and recurrence, microscopic metastases to the central or the lateral neck in well-differentiated thyroid cancer do not significantly affect outcome. As patients with clinically evident nodal disease are associated with worse outcomes, they should be treated surgically in order to reduce rates of regional recurrence and improve survival. The benefit of elective neck dissection remains unverified as the impact of microscopic disease on outcomes is not significant. Here we discuss the surgical management of neck metastases in well-differentiated and medullary thyroid carcinoma.

Keywords: Thyroid carcinoma, Neck dissection, Lymphatic metastases

BCNM-24/008

EFFECT OF 99MTC-MAA IMAGE RECONSTRUCTION VALUES ON DOSIMETRY IN TARE TREATMENT

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Introduction

In transarterial radioembolization (TARE) treatment, planning with 99mTc-MAA is one of the most important steps of the treatment. Post-processing imaging parameters and image reconstruction parameters are important in determining the correct treatment dose, especially with voxel-based dosimetry. The aim of this study was to investigate the effect of image reconstruction parameters on treatment dose in 99mTc-MAA planning.

Material and Method

Images of 30 patients who received 99mTc-MAA for TARE treatment, were included to this study. Image processing has been recostracted at workstation using iteration-subset values are respectively; 2-2, 2-5, 2-10, 2-20, 5-5, 5-10, 5-15, 5-20, 10-5, 10-10, 10-15, 10-20, 15-5, 15-10, 15-15, 15-20, 20-5, 20-10, 20-15 and 20-20. Volume and count values of the perfused area were determined using 5% and 10% threshould values in SPECT images.

Results

The perfused area volumes of thirty patients at 10%threshould values are 722, 648, 630, 615, 634, 624, 624, 609, 632, 626, 622, 611, 631, 623, 622, 611, 630, 623, 622 and 612 cm2 measured. The counts were 4566302, 5050578, 5058360, 4991871, 4983310, 5037283, 5086541, 4989636, 5109255, 5077754, 4937672, 4991870, 5109296, 50 78857, 5071626, 4994661, 5114986, 5077171, 5057384 and 4991746.

At 2 iteration 2 subset and 2 iteration 5 subset values volumes were found to be 14% and 3.1% more than the average, and the count values were 9% and 0.6% less than the average.

Concluision

Since there is no change that will affect the treatment dose, we recommend that the image reconstruction parameters be adjusted over 5 iterations and 5 subsets.

BCNM-24/009

VALUE OF FDG UPTAKE IN FAT TISSUE IN PREDICTION OF THERAPY RESPONSE IN PATIENTS WITH HODGKIN LYMPHOMA

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The role of the volume and distribution of fat tissue in patients with Hodgkin lymphoma is not very well established. The value of FDG uptake in different fat compartments is addressed in few studies in these patients.
Aim: The aim of the study is to evaluate the possibility of prediction of therapy response in patients with Hodgkin lymphoma based on volumes and SUV mean of the subcutaneous and visceral fat tissue derived from the pretreatment FDG PET/CT scan.
Material and methods; Retrospective analysis of the initial pretreatment PET/CT and end of treatment PET/CT of 39 patients with Hodgkin lymphoma was performed. According to the end of treatment scan the patients were divided in 2 groups Responders (Res) and Non responders (NRes).
Tissue and organ segmentation was performed on the initial PET/CT using DAFS from voronoihealthanalytics. Volumes and SUV mean of total body subcutaneous fat and visceral fat in the abdominal region was determined.
Results: The volumes of subcutaneous and visceral fat tissue did not differ between the groups. The value of SUV mean for the SAT in group Res was 0.19 +/-0.008, while in NRes group SUV mean was 0.23 +/-0.01. The difference between groups reached statistical significance p< 0 .001. The SUV mean of Non res was higher (0.51+/-0.1) than that of Res (0.45 +/- 0,01) but did not reach statistical significance P< 0.057)
Conclusion: The subcutaneous fat tissue showed higher SUV mean in patients that did not respond to therapy.

BCNM-24/010

FEASIBILITY STUDY – A MEAN FOR MULTI-FACETED ASSESSMENT OF THE IDEA OF ESTABLISHING RADIOISOTOPE PRODUCTION AND INTRODUCING NEW RADIOPHARMACEUTICALS INTO CLINICAL PRACTICE

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With the aim of obtaining an objective insight into the idea of establishing the production of zirconium-89 radioisotope and introducing ^{89}Zr-radiopharmaceuticals into clinical practice, a feasibility study was prepared.
This study was originally designed and covers several aspects. The preliminary analysis comprised a review of the application of ^{89}Zr-radiopharmaceuticals in clinical trials and a statistical data review regarding malignant diseases. The market research included searches on the distribution of medical cyclotrons and production sites of zirconium-89 radioisotope in Europe. The technical feasibility determination was based on the analysis of the technical capacities of the production site – University Institute of Positron Emission Tomography (UI PET), in terms of space and equipment necessary for producing zirconium-89 radioisotope. The economic feasibility estimation comprehended financial and pharmacoeconomic analysis. The production process was simulated and a cost analysis was used to calculate the cost of production of zirconium-89 radioisotope and ^{89}Zr-trastuzumab radiopharmaceutical. A cost-benefit analysis was conducted to assess the cost-benefit ratio of either testing patients with ^{89}Zr-trastuzumab PET/CT or biopsy as the comparison alternatives.
By the evaluation of the data from all conducted analyses, favourable and unfavourable factors and circumstances were identified, indicating some challenges but also opportunities towards better cancer management and research development.

BCNM-24/011

DEVELOPMENT OF [^{18}F]FLUOROMISONIDAZOLE SYNTHESIS METHOD BY CARTRIDGE PURIFICATION

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Hypoxic tumors are typically resistant to radiotherapy and chemotherapy and require alternative treatment strategies. Nitroimidazoles derivatives are an important class of compounds because they are retained in higher levels in hypoxic tumor cells than the corresponding normoxic cells. [^{18}F]fluoromisonidazole ([^{18}F]FMISO) as nitroimidazole derivative with ^{18}F radioisotope is widely used radiotracer for imaging hypoxia. The direct ^{18}F-fluorination using a tosylate precursor and [^{18}F]F$^-$ is a common method for the introduction of fluorine-18 into 1-(2′-nitro-1′-imidazolyl)-2-O-tetrahydropyranyl-3-O-toluenesulfonylpropanediol precursor (NITTP). Fully automated radiosynthesis procedures of [^{18}F]FMISO by cartridge purification are described only by few authors.
The goal of this work was to take a view of developing of synthesis method of [^{18}F]FMISO by solid phase extraction (SPE) method using IBA Synthera module and to study quality control parameters. Parameters for labeling and hydrolysis were optimized with regard to temperature, time and the amount of precursor. SCX, Alumina and six different RP extraction cartridge (HLB light, HLB plus LP, C18, tC18, C18 environmental, PS-RP) were used during development of [^{18}F]Fluoromisonidazole synthesis method by cartridge purification. The quality control of [^{18}F]FMISO was performed in accordance with the requirements of European Pharmacopoeia. The cartridges elution samples and waste samples were observed only for chemical by-products and radiochemical purity with HPLC and TLC analysis.
In this study, we successfully synthesized final product with 53,18 ± 3,44 % radiochemical yield, based on in-house prepared reagents with 5 mg NITTP and original cassettes for IBA Synthera. [^{18}F]FMISO complies with requirements of Ph. Eur. Monograph for Fluoromisonidazole (^{18}F) injection.

BCNM-24/012

CYTOLOGICAL CLASSIFICATION OF THYROID LESIONS ACCORDING TO BETHESDA

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Fine-needle aspiration biopsy-FNAB, is essential, rapid efficient and cheap method for evaluation of changes in the thyroid gland.
Lesions in the thyroid gland are categorized according to the criteria of Bethesda classification system in 6 groups: Classification group 1 – nondiagnostic or unsatisfactory, Classification group 2 – benign, Classification group 3 – Undeterminate: Atypical cells of undeterminate significance (AUS)/follicular thyroid lesions of undeterminate significance (FLUS), Classification group 4 – Folicular neoplasm of Hurthle cell type / Suspicious of follicular neoplasm of Hurthle cell type, Classification group 5 – Smears suspicious of malignancy (especially papillary type) but without full criteria for malignancy (cl. group 6). Follicular and Huthle cell neoplasms are excluded, Classification group 6 – Lesions made up of cells with morphologic characteristics of malignancy with hyper cellular smears with conclusive elements in favor of papillary, medullary, undifferentiated or anaplastic thyroid carcinoma as well as other malignancies. This classification offers high predictive value in histologically verified thyroid changes and reduces the probability of under treatment or over treatment.

BCNM-24/013

DEVELOPMENT AND IMPLEMENTATION OF [18F]NAF RADIOPHARMACEUTICAL PRODUCTION AT UNIVERSITY INSTITUTE OF POSITRON EMISSION TOMOGRAPHY

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[^{18}F]NaF injection is a sterile solution of fluorine-18 in the form of Sodium fluoride intended for visualization of metastatic bone disease. The automated full GMP in-house production process of [^{18}F]Sodium fluoride was developed on the dispensing module Clio.
The production module uses a single-use kit for dispensing doses. During the GMP process development, the kit was modified. On the first valve of the dispensing kit additionally were installed a one-way Y-connector and quaternary methyl ammonium anion-exchange cartridge (QMA). One end of the Y-connector was connected to the [^{18}F]F- cyclotron transfer line, while the other proximal end was connected to the saline vial for [18F]F- elution. Initial experiments were conducted utilizing various cartridge types and conditions to optimize the production process, followed by both cold and hot tests.
The developed fully automated GMP in-house method was validated, before being implemented in clinical practice. To ensure the microbiological safety of [^{18}F]NaF produced aseptically, validation of the aseptic production and cleaning validation were conducted. The stability study proved that the produced [^{18}F]NaF is physiochemically and microbiologically stable, up to 10 hours after the end of synthesis. Furthermore, the process validation was conducted to prove the reproducibility of the [^{18}F]NaF production process.
The validation results confirmed that the produced [^{18}F]Sodium fluoride fulfils the quality requirements stated in the European Pharmacopoeia monograph and can be used safely and effectively for its intended purpose.

Key words: [^{18}F]Sodium fluoride, development, production process, validation

BCNM-24/014

HEAD TO HEAD ANALYSIS OF SUVMAX AND TUMOR TO LIVER RATIO IN PATIENTS WITH PERITONEAL METASTASIS FROM OVARIAN AND COLORECTAL CANCER

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Objectives: The aim of study is to investigate and to compare head to head standard uptake value (SUV) and tumor-to-liver ratio (TLR) of peritoneal metastasis in patients with Stage II and III with ovarian cancer and colo-rectal cancer.
Methods and materials: Retrospective analysis of 56 patients with colorectal and ovarian cancer, referred for PET/CT in the 2023.
The inclusion criteria that the patients met were: stage II and III patients with patohistologically proven ovarian serous cancer or colorectal adenocarcinoma that underwent surgical procedures and specific oncologic treatment.
The semi quantitative analysis of SUV max on the peritoneal lesions and liver were calculated, and furthermore tumor to liver ratio was calculated also.
Results: 56 patients met the inclusion criteria, 30 patients with colo-rectal cancer (53.5%) and 26 patients with ovarian cancer (46.5%).
In the patients with colorectal cancer average SUVmax value of peritoneal metastasis was 4.6 (in range 1.2-14) and tumor-to-liver ratio was 1.6.
In the group with ovarian cancer patients average SUVmax value of peritoneal metastasis was 8.7 (in range 1.8-20.7) and tumor to liver ratio was 2.7.
Conclusion: The retrospective head to head analysis of peritoneal metastasis, showed that patients with ovarian cancer and peritoneal metastasis had significantly higher value of SUV max and tumor to liver ratio than the patients with colorectal cancer.

POSTER PRESENTATION

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BCNM-24/P01

THE VALIDITY OF FDG PET/CT IN THE DETECTION AND FOLLOW UP OF SEMINOMA

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Introduction: By reflecting glucose metabolism, FDG PET/CT has potential advantage over CT especially in post-therapy setting.
Aim: The aim of our investigation is determination of FDG PET/CT usefulness in detection of seminoma, therapy response evaluation and comparison to CT findings and tumor marker levels.
Material and methods: We investigated 82 men after orchidectomy and histopathological confirmation of seminoma, for the initial staging, restaging after chemo/radiotherapy with positive/uncertain CT, suspected recurrence on CT and elevated tumor markers. Clinical follow-up was of up to 8 years (mean 30.5 + 23.4 months) after first FDG PET/CT examination. Metabolic activity was analysed visually and semiquantitatively using SUVmax.
Results: FDG PET/CT was positive in 36 patients (43.9%) with average SUVmax of 7.9 ± 4.8. Recurrence was mostly found in retroperitoneal lymph nodes and distant metastases in lungs, bones, liver. Six findings were false positive and 3 false negative. Sensitivity, specificity, accuracy of FDG PET/CT were 92.3%, 86%, 89%, while CT had sensitivity 60.3%, specificity 66.6%. Pearson Chi-square test showed statistically significant difference between the results of FDG PET/CT and CT ($p= 0.016$). Significant correlation was found between positive FDG PET/CT findings and levels of LDH ($p=0.043$), while it was not significant between FDG PET/CT findings and AFP and FDG PET/CT and β -hCG ($p>0.05$).
Conclusion: FDG PET/CT was superior to CT in evaluation of therapy response, active disease in residual tissue and normal size lymph nodes, as well as when CT was negative and tumor markers were elevated. Elevated LDH contributes to positive FDG PET/CT findings.

BCNM-24/P02

GEOGRAPHIC LIVER STEATOSIS ACCIDENTALY DETECTED BY TC-99M HMPAO LEUCOCYTE SCINTIGRAPHY: A CASE REPORT

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Introduction: Geographic liver steatosis is commonly diagnosed by ultrasound, CT or MRI imaging techniques. Its detecting by Tc-99m HMPAO leukocyte scintigraphy has not been reported previously.
Aim: To present a case of geographic liver steatosis detected by a Tc-99m HMPAO leukocyte scintigraphy.
Materials and Methods: A 64-year-old female patient underwent a Tc-99m HMPAO leukocyte scintigraphy at the Department of Nuclear Medicine at the Clinical Hospital "Dr. Trifun Panovski" in Bitola. Post-administration of an intravenous injection of 430 MBq Tc-99m HMPAO labeled leukocytes, static whole-body scintigraphy at 1, 3 and 24 hours was performed at MEDISO AnyScan SPECT/CT camera.
Results: A female patient with a right knee endoprosthesis surgery eight months ago had a month-long fever. Despite taking antibiotics and examinations by an infectious disease specialist and an orthopedist, the cause remained unknown. She was referred for a bone scan which reveled suspected knee endoprosthesis infection. Afterwards, a scan with marked leukocytes was conducted. Persistent leukocyte accumulation around the endoprosthesis and notable accumulation in the right hepatic lobe was observed on the static scintigraphs. Due to the suspicion of hepatic abscess, an abdominal ultrasound was performed revealing geographic liver steatosis with the largest hyperechoic formation with a diameter of 6.7 cm in segment VIII of the liver.
Conclusion: The detection of marked leukocyte accumulation in the liver doesn't necessarily indicate an infectious focus. Non-infectious etiology like geographic liver steatosis should be considered when interpreting imaging results.

Key words: geographic liver steatosis, leucocyte scan.

BCNM-24/P03

MEDIASTINAL PARATHYROID ADENOMA: A CASE REPORT

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Introduction: Mediastinal parathyroid adenomas are rare, occurring in about 20% of cases of ectopic parathyroid adenomas. Its diagnosing and operation are challenging.
Aim: To present a case of mediastinal parathyroid adenoma detected by a Tc-99m MIBI SPECT/CT scintigraphy.
Materials and Methods: A 68-year-old female patient underwent a Tc-99m MIBI SPECT/CT scintigraphy at the Department of Nuclear Medicine at Clinical Hospital "Dr. Trifun Panovski" in Bitola. After administration of an intravenous injection of 800 MBq Tc-99m MIBI, early static scintigraphy in anteroposterior projection of the neck and thorax at 15 minutes and late static and SPEC/CT scintigraphy at 2 hours were performed on MEDISO AnyScan SPECT/CT camera.
Results: A female patient with chronic renal failure grade 4, elevated parathyroid hormone (PTH) (1529 pg/ml) and ionized calcium levels (1.4 mg/dL) was referred for a parathyroid MIBI scan in June 2023 due to suspected secondary hyperparathyroidism. SPECT/CT scintigraphy revealed hyperfunctional parathyroid tissue in the lower part of the left and right thyroid lobe and ectopic parathyroid gland located under the arch of the aorta. The patient in January 2024 underwent surgical treatment during which the lower left and right parathyroid glands were successfully removed. The mediastinal parathyroid gland was not extracted due to challenges in access. The postoperative PTH levels decreased to 644 pg/ml. The patient is currently being monitored by an endocrinologist and a nephrologist.
Conclusion: Diagnosing and treating of mediastinal parathyroid adenomas is complex. Collaboration between specialists is necessary for comprehensive patient management.

Key words: mediastinal parathyroid adenoma, diagnosis, treatment.

BCNM-24/P04

ATRIAL ^{18}F-FDG UPTAKE ON PET in ATRIAL FIBRILLATION

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An 80-year-old female patient was referred to our clinic for staging purposes with the diagnosis of squamous cell cancer originating from the floor of the mouth. As an additional finding, increased 18F-fluorodeoxyglucose (FDG) uptake on PET was detected in both atria, more intense and diffuse in the right atrium. Atrial fibrillation was detected on the ECG of the patient. Atrial fibrillation is the most common cardiac arrhythmia that can also be asymptomatic. Although physiologically FDG uptake is seen in the left ventricle, it has been reported in the literature that FDG uptake can be observed in the atria in atrial fibrillation.
In the study of Sinigaglia et al., which included 64 patients known to have atrial fibrillation, diffuse FDG uptake in the right atrium was detected in one-third of the patients, which is consistent wit our case report (1).

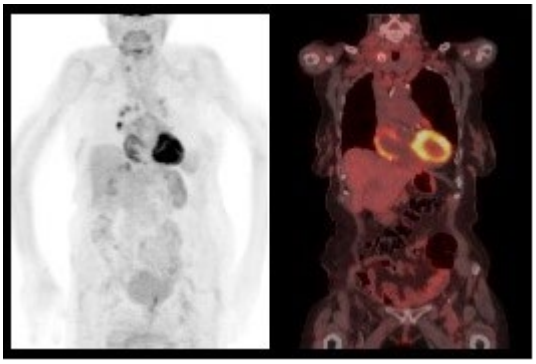

Figure 1: MIP and Coronal fusion images of the patient

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BCNM-24/P05

CLINICAL EXPERIENCE WITH IN VITRO LABELED LEUCOCYTES USING 99MTC-HMPAO IN DEPARTMENT OF NUCLEAR MEDICINE IN BITOLA

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Introduction: In accordance with the current European Union regulations, we performed in vitro radio-labbeled leukocytes. The well established technique was performed by trained personel under sterile conditions in a laminar flow cabinet. Nuclear medicine plays an important role in the evaluation of patients suspected infection.
Aim: To determine the labeling efficiency of Tc-99m HMPAO labeled leucocytes.
Material and methods: We conducted Tc-99m HMPAO labeled leucocytes scintigraphies at the Department of Nuclear Medicine in Bitola. Leukocytes were isolated from 40 ml of patients' blood. Tc-99m HMPAO (hexamethylpropylene amine oxime) was prepared by adding 1,5ml of Tc-99m pertehnetate generator eluate. The isolated leucocytes were labeled by addition of 637 MBq (± 65,37 MBq) in 0,9-1,1 ml Tc-99m HMPAO solution and safely injected to the patients. The labeling efficiency and quality control were assessed and imaging was performed to all patients on Mediso Anyscan SPECT/CT camera.
Results: The studies were performed between April 2022 - April 2024. 17 patients, aged from 42 to 80 years, were included (3 male (17,6%) and 14 females (82,3%). A quality control for determination of the labeling efficiency of leukocytes was conducted. The mean labeling efficiency was 70,56 % (±9,5) with quality control 88,8 % (±7,83). Imaging results of leukocyte scintigraphy showed effective labeling and were useful for infection evaluation.
Conclusion: These findings suggest that Tc99m-HMPAO in vitro labeled leukocytes are gold standard for imaging infections with high efficiency and reliability in clinical practice.

Keywords: Tc99m-HMPAO, leucocytes, labeling efficiency

BCNM-24/P06

INCIDENTAL FINDINGS OF PULMONARY PERFUSION DEFECTS ON VENOSCINTIGRAPHY

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Introduction: Venoscintigraphy is a nuclear medicine imaging technique primarily used to diagnose deep vein thrombosis (DVT). Incidental findings during venous scintigraphy, particularly pulmonary perfusion defects, can present diagnostic challenges and require further evaluation.
Aim: To determine the frequency of incidentally discovered pulmonary perfusion defects among patients referred for venoscintigraphy.
Materials and Methods: We analyzed 43 patients referred for venoscintigraphy at the Nuclear Medicine Department of Bitola Clinical Hospital from 2021 to March 2024 due to venous disorders. The study was performed by intravenous administration of 110-150 MBq of 99mTc-macroaggregated albumin (99mTc-MAA) into the feet. Lower extremity venous scintigraphy and static perfusion scintigraphy of the lungs were conducted using a MEDISO AnyScan SPECT/CT camera.
Results: 43 patients (12 men (27.9%) and 31 women (72.1%)) were analyzed, aged from 29 to 81 years. Pulmonary perfusion defects were observed in 67.4% of cases (9 men (31%) and 20 women (69%)). The breakdown of positive scintigraphies per year was as follows: 2021 - 5 out of 9, 2022 - 9 out of 15, 2023 - 10 out of 11, and 2024 - 5 out of 8.
Conclusion: The data suggest a high incidence of incidentally detected pulmonary perfusion defects during scintigraphic evaluations of the lower extremity deep venous system from 2021 to March 2024.

Key words: venoscintigraphy, pulmonary perfusion defects

BCNM-24/P07

CLINICAL ROLE OF Q-SPECT IMAGING IN PULMONARY THROMBOEMBOLISM ASSESSMENT

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Objective: The rising referrals to nuclear medicine clinics post-COVID, especially for chronic thromboembolic pulmonary hypertension (CTEPH), prompted suggestions for perfusion-only Q-SPECT use. Our aim is to evaluate Q-SPECT's efficacy in triaging non-pathological patients at our secondary care center.[1-3].

Materials and methods: Between January 2022 and February 2024, 42 patients participated. After Tc99m-MAA injection, a 30-second planar AP image followed by a 12-minute SPECT imaging was conducted. Non-contrast thoracic CT images were obtained separately if there is a perfusion defect. Perfusion defects were categorized as wedge (typical) or atypical, significant if consistent with CT findings. Evaluation followed MSKCC classification [4].

Results: 43% were female, median age 53. 52.4% had normal Q-SPECT results, effectively excluding pulmonary thromboembolic disease. Among patients with defects, 21.4% exhibited $\geqslant 5$ typical wedge defects, with no additional contribution from CT. Distribution: 1 defect (4.8%), 2 defects (11.9%), 3 defects (4.8%), and 4 defects (4.8%). While CT correlation was performed in 47.6%, 14.3% of non-segmental atypical defects had non-embolic causes. Findings were confirmed after a two-month follow-up.

Conclusion: Perfusion SPECT alone yielded clinically useful results in 88.1% of patients, demonstrating its applicability for PTE diagnosis in centers with gamma cameras. Q-SPECT enables PTE evaluation in a larger patient population with ease.

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BCNM-24/P08

DIAGNOSTIC EVALUATION OF UTERINE 18F-FLUORODEOXYGLUCOSE UPTAKE: A CASE SERIES REVIEW

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Introduction: Hybrid imaging with ^{18}F-FDG is now the standard way to check for disease stage, treatment response, recurrence, and follow-up in many oncological diseases. Incidental high endometrial uptake poses significant diagnostic challenges, often leading to false results and potential misdiagnoses.
The goal of this article is to draw attention to potential uterine pathologies discovered incidentally during PET/CT investigations.
Materials and methods
We examined ten ^{18}F-FDG PET/CT studies that revealed unexpectedly high uterine uptake in female patients undergoing scans for mainly oncological pathology.
The patients' ages ranged from 35 to 70, and none had prior knowledge of any genital disorders.
Results: Six of these patients were postmenopausal, and four were of reproductive age, one of whom was postpartum.
In the 4 patients of reproductive age, the mean maximum standardized value normalized by lean body mass (SULmax) was 6.60 ± 1.42. The highest value, 7.96, was observed in the postpartum patient. The postmenopausal group exhibited a mean SULmax of 6.99 ± 3.77, with the maximum SULmax value of 16.6 noted in a 66-year-old patient.
Based on the existing literature [1-3], all patients in the post-menopausal group were referred to a gynecological evaluation, particularly because high uptake in postmenopausal females often indicates a pathological condition, often malignant.
Conclusion: Increased uterine uptake in postmenopausal patients is commonly linked to malignancy, while in premenopausal patients, it may be related to functional changes.
Increased uterine uptake in postpartum women generally indicates normal physiological changes, though the duration of this activity is unknown.
Nuclear medicine physicians must understand how physiological FDG uptake in the female genital area is affected by age, menstrual cycle phase, and pregnancy.

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BCNM-24/P09

UNEXPECTED BIODISTRIBUTION OF ^{99M}TC-DMSA: INVESTIGATION OF THE NONCONFORMITY

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Objective: ^{99m}Tc-DMSA is considered as a gold standard SPECT radiopharmaceutical for renal cortex scintigraphy. For decades, different kits have been used in our institute (either in-house prepared or commercially produced) and renal scintigraphy was performed according to an established protocol. We present a case study of unexpected biodistribution of ^{99m}Tc – labeled commercial kit from a new supplier, soon after its introduction in routine use.

Methods: DMSA kit (Mercapton, Medi-Radiopharma, Hungary) was labeled with 1200 MBq of ^{99m}Tc pertechnetate from a fresh generator eluate (Ultra-Techneknow FM Generator, Curium, Netherlands) to a final volume of 5 mL. Quality control was performed with paper chromatography (Whatman 1) in 100% acetone and 0,4% of free ^{99m}Tc pertechnetate was found as a radiochemical impurity. Unit doses were injected in 6 patients and scintigrams performed within 2-3 hours after application, in conformity with our protocol. However, an unusually high radiotracer uptake was observed in the liver and spleen in all patients. As the pharmacodynamic properties of ^{99m}Tc-DMSA depend on the final pH, we assessed the residual radiopharmaceutical in the kit vial and measured a pH of 5.5.

Conclusion: The optimal pH for efficient labeling and pharmacokinetic of ^{99m}Tc-DMSA is considered to be between 2.3-3.5, as per literature date and our long- term experience. The labeled Mercapton kit showed unexpectedly higher pH value, resulting in slower renal cortex accumulation and decreased liver and spleen washout. When the time of acquisition was prolonged to over 3 hours in the following studies, this nonconformity was not observed.

BCNM-24/P10

CONVERSION OF HYPOTHYROIDIZM TO HYPERTHYROIDIZM

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Introduction: Transformation from Hashimoto's disease to Graves' disease is considered rare.The reason is asumed to be shift from TSH receptor-blocking antibodies to TSH receptor-stimulating antibodies.
Aim: To present a case of conversion of hypothyroidism to hyperthyroidism.
Materials and Methods: We report a case of a 40-year-old woman seen at the Department of Nuclear Medicine, Clinical Hospital "Dr. Trifun Panovski," Bitola, who experienced a transition from hypothyroidism to hyperthyroidism. Laboratory tests for TSH, fT4, and aTPO were conducted using an IMMULITE 2000 analyzer, along with thyroid scintigraphy using Tc99m-pertechnetate
Results: A 40-year-old female patient visited the Department of Nuclear Medicine, Clinical Hospital "Dr. Trifun Panovski," Bitola, for the first time in June 2014 with a TSH level of 46.4. She was prescribed Levothyroxine 100 mcg and monitored regularly. She was pregnant in 2019. In June 2023, her TSH level was suppressed to <0.004 with an elevated fT4 of 25.4. The Levothyroxine dosage was reduced, but her fT4 levels continued to increase in subsequent checks (30.0/32.4/34.7/36.2). In March 2024, Levothyroxine therapy was stopped due to a TSH level of 0.005 and fT4 of 36.0, along with an aTPO level of 34.6. In April 2024, her TSH was 0.006 and fT4 level rose to 40.2, leading to the initiation of Thiamazole therapy at 2x5 mg per day.
Conclusion: Although uncommon, cases of conversion from hypothyroidism to hyperthyroidism can occur.

Key words: Hypothyroidism, conversion, hyperthyroidism

BCNM-24/P11

SHOULD WE PERFORM BONE SCINTIGRAPHY ONLY IN HIGH-RISK PATIENTS' GROUP WITH NEWLY DIAGNOSED PROSTATE CANCER? A RETROSPECTIVE ANALYSIS BASED ON RISK-GROUP STRATIFICATION

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For more than half a century, nuclear medicine has played a significant role in the early detection of metastatic disease in newly diagnosed prostate cancer patients. ^{99m}Tc-bone scintigraphy with labeled diphosphonate compounds is a widely available and highly sensitive (83%) imaging method that is still a part of most recent European Association of Urology guidelines for prostate cancer(1,2). EAU guidelines define three different risk groups based on TNM status, Gleason Score and PSA serum levels at the time of diagnosis (low, intermediate and high-risk), and recommend performing ^{99m}Tc-bone scintigraphy only in high-risk patients or symptomatic patients, regardless of risk group.
We retrospectively analyzed 294 bone scans of newly diagnosed prostate cancer patients that were referred for bone scintigraphy at the University Clinical Center of Serbia between January 2019 and January 2023, and stratified them into 3 different risk groups based on EUA criteria: 26 patients were in low-risk, 110 in intermediate-risk and 158 in high-risk group. In the low-risk group, none of the patients had bone metastatic disease; in the intermediate-risk group, 10/110 patients(9.1%) had metastatic bone lesions and in the high-risk group 54/158 patients(34%) had at least one metastatic lesion in the skeleton. Interestingly, in the intermediate-risk group, 7/10 patients were with Gleason Score 7(4+3).
Based on the data we gathered from analyzed bone scans of risk-group stratified patients, we can conclude that while bone-scintigraphy might not be needed in the low-risk patients, we can strongly suggest performing bone scintigraphy in intermediate risk-group of patients(in addition to high-risk group).

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BCNM-24/P12

^{18}F-FDG PET/CT IN DETECTION OD SUSPICIOUS NEUROLYMPHOMATOSIS: A CASE REPORT

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We present a case of 22 Years old female who was referred for control FDG PET/CT with the symptoms of hip pain, loss of appetite and the malaise.
She was previously diagnosed with Natural Killer-Non-Hodgkin lymphoma, after left mastectomy with lymph dissection, one year ago. After completed chemotherapy followed by autologous bone marrow transplantation, a FDG PET/CT scan revealed no residual tumor with completed metabolic response.
However, 4 months after achieving complete remission, she developed unspecific neurological symptoms with weakness, left hip pain, loss of appetite and the malaise. Additional investigations were made but laboratory and neurological findings were negative. Furthermore, brain computerized tomography and spinal x ray were also negative, without any findings correlated with the disease. Additionally, 2 weeks before FDG PET/CT whole body low dose CT was made, with negative findings.
However, FDG-PET/CT revealed multiple hypermetabolic lesions in projection of neural foramen and along spinal nerves at the levels C5 to Th2, Th8 to S4, with increased metabolic activity and SUVmax=8.3, which corresponded with the patient's unspecific neurological symptoms. These findings were suspected for NHL recurrence and presented neurolymphomatosis.
Five months after that, patient was referred for therapy assessment scan after completed chemotherapy followed by intratecal chemotherapy, and FDG PET/CT, showed no FDG avid lesions.
The patient died almost 1 year after her initial diagnosis of neurolymphomatosis.

BCNM-24/P13

TYPICAL PULMONARY CARCINOID WITH ATYPICAL METASTASIS: A CASE REPORT

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Introduction

Pulmonary carcinoids account for less than 30% of all carcinoid tumors and only 1-2% of all pulmonary malignancies. Histologically, they are classified as typical carcinoid, atypical carcinoid, small cell lung carcinoma and large cell neuroendocrine carcinoma.

Case Description

We present a case of a 56-year-old female with a history of a pulmonary carcinoid tumor located in the left superior pulmonary lobe, for which she underwent a lobectomy with lymphadenectomy. After five disease-free years, she presented with a left posterior thoracic wall mass, originating from the ninth left rib. Biopsies taken from the mass indicated an atypical pulmonary carcinoid metastasis. A bone "whole-body" scintigraphy with 99mTc-HDP revealed extensive osteogenic focal uptake located in several vertebrae, the rib cage and in the pelvic bones, suggestive of bone metastases.

The PET/CT scan with ^{18}F-FDG revealed several metabolic active lesions located in the thyroid, pancreas, liver and bone. The thyroid had multiple heterogeneous, hypodense lesions avid for FDG. In the pancreas there was an expansive solid mass, which showed a moderate uptake of FDG. The numerous bone metastases previously described, showed a high avidity for FDG. Biopsies from the thyroid lesions suggested pulmonary carcinoid metastasis, while the pancreatic biopsy was negative for NET metastasis. The patient is undergoing chemotherapy.

Conclusion

This case showcases the importance of ^{18}F-FDG PET/CT scan in the long-term management of typical pulmonary carcinoid, identifying various metastases even in unusual, peculiar localization, thus changing the therapeutic approach.

BCNM-24/P14

THE EFFECT OF ^{18}FDG PET/CT AND RELATED PARAMETERS ON STAGİNG, DİSEASE MANAGEMENT AND PROGNOSİS İN PATİENTS WİTH CHOLANGİOCARCİNOMA

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Aim: We aimed to evaluate the relationship of ^{18}FDG PET/CT parameters with diagnostic efficacy, disease management and prognosis of patients with CCK. In addition, the prognostic value of spleen/liver ^{18}FDG uptake ratio was also investigated.
Materials and Methods: Clinical and imaging findings of 39 patients who met the diagnostic criteria and underwent ^{18}FDG PET/CT imaging for staging between 2013 and 2023 were retrospectively analysed.
Results: The tumor was intrahepatic in 34 patients and extrahepatic in 5 patients. PET/CT detected nodal involvement in 21 patients (53.8%) and distant metastasis in 35 patients (89.7%).14 cases (35.9%) had regional-distant metastasis detected by PET/CT but not by MRI/CT and the stage of the disease changed accordingly. SUVmax, SUVmean, MTV, TLG, TLR (tumor/liver parenchyma SUVmax),TBR (tumor/blood pool SUVmax),TSR (tumor/spleen parenchyma SUVmax) and SLR (spleen/liver SUVmax) values did not differ according to tumor locations. Recurrence occurred in 14 patients (35.9%) and 2 patients survived at the end. When cut-off values for parameteres were determined by Youden index, PFS was significantly shorter in patients with SLR value below 0.94 compared to the other ones (p: 0.04). Nodal involvement, metastatic location, other PET/CT parameters, had no significant effect on progression-free survival and overall survival.
Conclusion: Our findings emphasise the efficacy of ^{18}FDG PET/CT in the staging of nodal and distant metastasis, similar to multiple studies in patients with CCK. Although SLR was found to have significant efficacy in PFS among the parameters we analysed, it is appropriate to evaluate the prognostic significance of these parameters in larger patient groups.

BCNM-24/P15

YOUNG PATIENTS UNDER 30 YEARS OF AGE EVALUATED BY BONE SCINTIGRAPHY – A SINGLE CENTER STUDY

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Introduction: Bone scintigraphy (BS) is one of the complementary methods together with other morphological diagnostics, for evaluation of a bone pain in diverse diagnosis in young patients. Although not specific, it is a highly sensitive method to depict osteoblastic activity in the region of interest.
We evaluated the indications for BS of 29 consecutive patients who were admitted to our nuclear medicine department for a bone scan evaluation, in 2023.
Materials and methods 29 patients, both gender (15 males and 14 females), 4 – 29 years, (mean age 25,5 years) underwent bone scintigraphy with a standard protocol (99mTc-MDP in dose calculated by age). All patients performed dual-phase BS (including pool phase, 5 minutes after iv administration of the radiotracer and then followed by a late phase of whole-body scan, WBS, 3 hours after the injection). Only in two patients, no early phase was performed.
Results: Nearly all patients (n=27, 90%) complained of bone pain, that was located mainly in the extremities (lower leg - 7, in the knee - 7, upper leg - 5, upper arm - 3, lower arm - 2, hand - 2, spine - 1). Three of the patients were sent for evaluation of bone metastasis (1 – neuroblastoma, 1 – neurofibromatosis, 1 – rhabdomyosarcoma), while the rest were sent for evaluation of a primary bone tumor – 15 patients (Ewing sarcoma - 3, Enchondroma - 3, Non-ossifying fibroma - 4 Osteochondroma - 2, Osteoblastoma – 1, Osteoid osteoma – 1, Bone cyst – 1), metabolic disease (Fibrous dysplasia -2), Inflammation – 2 (Coxitis and Synovitis), Insula compacta – 1, Bone osteolysis – 2 patients, Synovial Chonromatosis – 1patient. No feedback existed for 3 patients. Our scan revealed positive both pool phase and late static WBS in 16 patients, 6 patients had negative pool phase, but positive WBS, and in 2 patients no accumulation was seen in both phases. Five patients showed accumulation of the radiotracer in other bones, despite the primary region of interest.
Conclusion: WBS - BS with its high sensitivity still plays its role in evaluation of bone pain by detecting metabolic activity in various etiologies, especially due to a primary bone tumor.

Key words: bone scintigraphy, young, bone pain, bone tumor, WBS

BCNM-24/P16

SIGNIFICANCE OF DETERMINATION OF VITAMIN D AND MARKERS OF SYSTEMIC INFLAMMATION IN PATIENTS WITH GASTROENTEROPANCREATIC NEUROENDOCRINE TUMORS

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Introduction: Numerous studies indicate that vitamin D deficiency in patients with neuroendocrine tumors (NET) correlates with disease severity and outcome. The aim of our research was to determine the importance of vitamin D measurement in patients with gastroenteropancreatic NET (GEP NET), as well as its correlation with markers of systemic inflammation.
Methodology: The research was conducted as a cross-sectional study that included 27 (11 men (40.7%) and 16 women (59.3%)) patients with GEP NET treated at the Department for nuclear medicine, University Clinical Center Kragujevac, Serbia. Concentrations of vitamin D as well as markers of inflammation and calculated inflammation indexes (total number of leukocytes, absolute number of neutrophil leukocytes, absolute number of monocytes, absolute number of lymphocytes, C reactive protein (CRP), the ratio of the absolute number of neutrophils and lymphocytes (NLR), the ratio of the number of platelets and the absolute number of lymphocytes and systemic inflammatory response index (SIRI)) were measured by standard laboratory methods.
Results: The average age of the subjects was 58.7±11.08 years. The average value of vitamin D in the studied population was 17.05±6.01 ng/ml (range 20-40 ng/ml). Analysis of the relationship between vitamin D and markers of systemic inflammation showed that the concentration of vitamin D negatively correlates with the concentration of CRP (r=-0.232, p=0.031), NLR (r=-0.080, p=0.752), PLR (r=-0.005, p=0.082) and SIRI (r=-0.037, p=0.024), where the relationship of vitamin D concentration with CRP and SIRI was shown to be statistically significant.
Conclusion: Vitamin D deficiency emphasizes systemic inflammation in patients with GEP NET and laboratory monitoring of these parameters could be useful in assessing the further course of the disease.
Keywords: neuroendocrine tumors, vitamin D, markers of inflammation.

BCNM-24/P17

HAS THE VALUE OF 18F-FDG PET/CT BEEN UNDERESTIMATED IN PROSTATE CANCER?

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Prostate cancer is an increasing burden on society. It is estimated that the incidence rate of prostate cancer in Europe alone was 330,000 in 2023. The most significant risk factor for developing prostate cancer is age, and since we are being faced with an aging population, it is crucial that firm protocols and guidelines for screening and follow up of these patients exist.
At the University Clinical Centre of Serbia, we recently introduced 99mTc-PSMA SPECT/CT examinations for prostate cancer patients. Patients were selected based on the following criteria: initial treatment (either radical prostatectomy or radiotherapy) and a biochemical recurrence. The average PSA level measured amongst them was 5.07.
Out of the 30 patients examined, despite having a positive (and growing) PSA level, 9 of them had metabolically negative findings on PSMA SPECT/CT. These patients were then referred for an additional 18F-FDG PET/CT examination. This method indeed showed positive FDG metabolic activity in the morphologically suspicious lesions with no PSMA metabolic activity.
From these results, we can conclude that although 99mTc-PSMA SPECT/CT is the method of choice for prostate cancer patients with a biochemical recurrence, there is still room for 18F-FDG PET/CT in their diagnostic work up. This is mostly relevant for patients that are negative on 99mTc-PSMA SPECT/CT with increasing PSA levels.
Ultimately, the results of any diagnostic imaging will determine the next steps in the patients' treatment. Patients with positive FDG examinations will not be candidates for radioligand therapy and other methods of treatment must be considered.

BCNM-24/P18

STRIATAL DOPAMINE TRANSPORTER SPECT IMAGING. COMPARISON OF VISUAL ANALYSIS AND SEMIQUANTIFICATION WITH A DATABASE OF NORMAL SUBJECTS

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Aim: The aim of our study was to compare visual and semiquantitive analysis with the results of the analysis after comparison with a normal database.
Materials-Methods: Four-hundred and fifty patients with parkinsonian symptoms were enrolled, age±SD=68±10.6 years, who underwent a brain SPECT 3-4 hours after the i.v. administration of 185 MBq ^{123}I-ioflupane. On visual assessment, we evaluated tracer uptake by right(R) and left(L) striatum, R-L putamen and R-L caudate. Semiquantification was made using the three slices which showed the most intense tracer uptake in the above regions and were compared with the occipital cortex, while the Parkinson's Progression Markers Initiative-PPMI normal database was used for comparison.
Results: The sensitivity of visual evaluation ranged between 82.7% and 98.7% for L-caudate and L-R caudate, respectively, compared with the results of PPMI, while specificity ranged between 74.6% to 87.9% for L-striatum and R-caudate, respectively. Comparing the results of semiquantitative assessment with those of PPMI, we found that the optimal cut-offs for L-striatum was $\leqslant 2.46$ (sensitivity 88.6%, specificity 85.7%), for R-striatum was $\leqslant 2.29$ (sensitivity 88.5%, specificity 91.5%), for L-putamen was $\leqslant 2.37$ (sensitivity 92.9%, specificity 86.8%), for R-putamen was $\leqslant 2.45$ (sensitivity 98.8%, specificity 82.9%), for L-caudate was $\leqslant 2.38$ (sensitivity 86.7%, specificity 87.9%) and for R-caudate was $\leqslant 2.49$ (sensitivity 88.9%, specificity 85.9%).
Conclusion: Identification of the optimal cut-offs in semiquantitative analysis of striatal dopamine transporter SPECT after comparison with a normal database, may be useful, especially in nuclear medicine departments where normal databases are not available.

BCNM-24/P19

BIOCHEMICAL RECURRENCE OF PROSTATE CANCER. COMPARISON OF 18F-PSMA-1007 FINDINGS BETWEEN PATIENTS TREATED WITH RADICAL PROSTATECTOMY AND RADIOTHERAPY/HORMONAL THERAPY

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Aim: Prostate cancer treatment includes radical prostatectomy-RP, radiotherapy-RT and hormonal therapy-HT. However, the decision of the optimal treatment modality has not reached a consensus yet. The aim of our study was the comparison of 18F-PSMA-1007 findings in biochemical recurrence between patients treated with RP and those treated with RT and/or HT.
Materials and methods: Thirty-three patients were included, 17 of them received RT and/or HT (Group A) and 16 underwent RP (Group B). In Group A, age ranged between 64 to 85 years old, PSA ranged from 0,32 to 62 ng/ml (mean value 12,5 ng/ml) and Gleason score ranged from 6 to 9. In Group B, age ranged between 58 to 84 years old, PSA ranged from 0,21 to 18.9 ng/ml (mean value 4.52 ng/ml) and Gleason score ranged from 6 to 9.
Results: Increased 18F-PSMA-1007 uptake in the prostate gland was found in 85% of patients in Group A, while lymph node uptake was found in 45.8% and uptake in bone lesions in 54% of them. In Group B, we found increased uptake in the prostate bed in 54% of patients, and uptake in lymph nodes and bone lesions in 54.1% and 31.2%, respectively.
Conclusion: Prostate cancer patients treated with RT and/or HT may experience prostate gland recurrence, as well as bone lesions to a greater extent compared with patients treated with RP. On the contrary, RP may lead to a greater lymph node disease, while almost half of the patients may show recurrence in the prostate bed.

BCNM-24/P20

INVESTIGATION OF RESIDUAL ACTIVITY IN SYRINGES POST-ADMINISTRATION OF TC-99M-MDP FOR BONE SCANS AND DTPA FOR RENAL STUDIES IN NUCLEAR MEDICINE

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Introduction: Residual activity in syringes post-administration of radiopharmaceuticals is a critical concern in nuclear medicine, affecting dosing accuracy and radiation safety. This study examines residual activity levels in syringes following the application of two commonly used radiopharmaceuticals: Tc-99m-methylene diphosphonate (Tc-99m-MDP) for bone scans and diethylene-triamine-pentaacetate (DTPA) for renal studies.

Aim: Optimization of the activity administered to patients for the intended purpose, ensuring satisfying diagnostic image quality and radiation safety, while also minimizing unnecessary radioactive waste.

Materials and Methods: A sample of 100 consecutive patients was included for each pharmaceutical, reflecting the routine practice of the institute, with each patient receiving the standard injected activity for each pharmaceutical as routinely administered on a daily basis. Using dose-calibrator detection techniques, the pre-prepared activity for each patient was measured just before injection. Following administration, residual activity measurements were conducted. Additionally, background levels were carefully accounted for in the analysis.

Results: Findings delineate distinct residual activity patterns influenced by factors such as radiopharmaceutical characteristics, syringe materials, and injection techniques. The averaged values of residual activity were found to be 10.5% for MDP and 8.6% for DTPA. Furthermore, different types of injections were investigated for MDP, revealing that the insulin needle yielded the lowest average percentage of residual activity.

Conclusion: This study underscores potential dosing discrepancies and radiation exposure risks in clinical practice. Strategies to mitigate residual activity and enhance radiation safety are proposed, emphasizing the importance of optimizing dosing precision and radiation protection in nuclear medicine procedures employing Tc-99m-MDP and DTPA

BCNM-24/P21

THE ROLE OF TC-99M (RBC) SPECT/CT IN THE DIAGNOSIS OF GIANT HEPATIC HEMANGIOMA – A CASE REPORT

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Introduction: Hemangioma is the most common benign tumor of the liver. Hepatic hemangiomas (HH) are usually small in size and asymptomatic, so they are often reported as incidental findings in imaging studies. It is important to differentiate them from other malignant hepatic tumors. (HH) probably originate from the proliferation of vascular endothelial cells and the increase in their size is due to dilation. A giant hemangioma (GH) is defined as a tumor sized 4 cm and above. GH can cause abdominal discomfort, pain, and because of the potential risk for rupture and bleeding, may require surgical treatment.

Case presentation: We present the case of a 53-year-old-woman, complaining of abdominal discomfort and pain, located in the right upper quadrant. Physical examination revealed an enlarged liver, palpable mass at the upper abdomen and the ultrasound examination showed a large hyperechogenic tumor mass, located in the right lobe of the liver. CT scans showed a heterogenic mass in the liver with central zones of pronounced hypodensity. We performed Tc-99m red blood cell (RBC) scintigraphy using the in-vivo method. Massive hemangioma d=153mmx115mm was detected spreading almost in the whole right liver lobe.

Conclusion: Tc-99m RBC scintigraphy is a noninvasive safe, cost-effective method that provides the most specific diagnosis of HH. The specificity and sensitivity increase using SPECT/CT. In this case, we emphasize the role of Tc-99m RBC SPECT/CT in the diagnosis of giant hemangioma and localization of the tumor.

Keywords: Hepatic hemangioma, Tc-99m RBC SPECT/CT

BCNM-24/P22

ASSESSMENT OF THE SEQUELAE OF PULMONARY MICROTHROMBOEMBOLISM BY PERFUSION SCINTIGRAPHY OF THE LUNGS AFTER INFECTION WITH COVID-19

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Background: Breathing difficulties can be a sign of sequelae of microthromboembolism of the pulmonary parenchyma (PMT) in patients after the recovery period following the infection with COVID-19.
Aim: The aim was to detect the existence of sequelae of PMT in previously proven cases during the course of infection with Covid 19, who still had breathing problems after the recovery period.
Methodology
From 01.05.2023. to 01.04.2024. a total of 36 patients, with a mean age of 58 ± 12 years with previously diagnosed PMT by perfusion lungs scintigraphy (PLS) during the infection with Covid 19, were referred to control PLS. The criteria for referral to control PLS were breathing difficulties, normal D-dimer values, normal cardiac status, and a negative lung CT.
Results:In 87% of patients, PMT sequelae were detected by PLS. In 13% of patients, the PLS findings were either normal or inconclusive.
Discussion:Sequelae of PMT usually exist in the presence of difficulty breathing after Covid 19, with normal D-dimer levels, normal heart findings, and normal lung CT findings. The detection of PMT can properly direct the therapeutic approach to alleviate the daily problems that such patients have. Prolonged anticoagulant therapy has not been proven to be the method of choice, so the approach to the treatment of patients with sequelae of PMT is individual.
Conclusion: PLS can help diagnose sequelae of PMT after recovery from COVID-19 infection. Diagnosing the sequelae of PMT has a great impact on the correct therapeutic approach in this group of patients.

Keywords: COVID-19; Perfusion lungs scintigraphy; Sequelae of microthrombosis

BCNM-24/P23

RADIONUCLIDIC IMPURITIES IN ^{18}F[FDG] of PET

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The most widely used radiopharmaceutical for PET imaging still remains ^{18}F[FDG]. During the routine production of ^{18}F[FDG] and bombardement of the ^{18}O water radionuclide impurities are produced. All of the impurities present in the ^{18}F radioactive isotope are generated in the target of the cyclotron, due to radioactivation of the metal target housing (target body and the beam entrance window). The ^{18}F is produced with cyclotron GE PETtrace 800 series with fixed beam energy of 16.5 MeV, while the synthesis is done with Synthera V2 module (IBA Belgium). The aim of this study is to evaluate the percentage of the total radionuclide impurities in the final sample of ^{18}F[FDG] in a period of 6 months.All of the radionuclide impurities are produced in the target of the cyclotron during the irradiation, from proton beam interactions with the Nb target body and the Havar foil window and from secondary neutron interactions with the Nb target body and the Havar foil window.

With the cyclotron fixed beam energy and the known material of the target body (Nb) and the Havar foil (alloy of cobalt, chromium, nickel and traces from manganese, molibdenum, iron and other metals) we know all the possible reactions and all radionuclides that can occur in the final sample. Radionuclidic impurities are determined using scintilation detector, RADEK MKGB-01 gamma spectrometer. The method of the test is to measure the total activity of all impurities detected in the spectrum of the final sample of ^{18}F[FDG] with half life longer than 2h. The spectrum of the final sample is colected at least 24h after the production to allow the ^{18}F to decay. The criteria for this test is that the total radioactivity due to radionuclidic impurities should not be more than 0.1 % for every batch produced, according to the limitations given in the European Pharmacopeia.

During the evaluated period the measured and calculated percent of the radionuclidic impurities was between 0.0001 % and 0.0007 %. The mean value of the radionuclidic impurities in the final sample was 0.0005 %.

The results and measurement of the radionuclidic impurities present in the final sample obtained during the routine production of ^{18}F[FDG] in UI PET have not exceeded the criteria given in the European Pharmacopeia.

BCNM-24/P24

QUALITY CONTROL OF THE IRIS INJECTOR SYSTEM

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Standardized uptake value (SUV) is a semi quantitative measure of the tracer uptake in a region of interest that normalizes the lesion activity to injected activity and a measure of volume of distribution. This calculation depends of measured activity concentration, injected dose, and body weight. Therefore, the dose calibrator quality control has to be maintained.
In our center IRIS automated injection system is used to perform the injection of radiopharmaceuticals to the patients.
The system can dilute, measure the activity, and inject to the patient automatically.
Gas Ionization chamber is integrated within the system and daily quality control is performed. Routine (QC) tests are repeated at specific intervals to establish and document changes from the initial performance at acceptance testing of dose calibrator. The recommended tests by EANM Physics Committee and the EANM Working group: Physical inspection, High voltage, Clock accuracy, zero adjustment, Background counts, Contamination check, Constancy, Stability, Accuracy and Linearity are followed. In this paper will be presented results of performed routine Quality Control tests of this system. The records need to be maintained to demonstrate actual calibrator operation including personnel training, competence testing and compliance to the quality assurance program.

BCNM-24/P25

SPECT/CT IN THE DIAGNOSIS OF ECTOPIC THYROID GLAND

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Introduction: The lingual thyroid is the most common location of ectopic thyroid tissue, due to developmental anomaly of the descent of the thyroid gland. Misdiagnoses still occur, considering the low prevalence of the disease, when only a single diagnostic technique is performed.
Case report: A 38-year-old woman was referred to our Department for thyroid status evaluation. The patient was treated with Levothyroxine for two years due to mildly elevated thyroid-stimulating hormone (TSH) level and nonvisualization of the thyroid gland on ultrasound. Two years later, she voluntarily cut off the therapy, given the suppressed TSH serum level and the symptoms developed, such as palpitations and anxiety. Our laboratory status revealed euthyroid status with hormonal values within the reference range (FT4=16.35pmol/L, FT3=6.33pmol/L, TSH= 2.7mIU/L).
As the thyroid gland was not visualized in the neck region on ultrasonography, a thyroid scan was initiated to confirm the clinical suspicion of an ectopic thyroid gland. After 20 minutes of intravenous injection of 74 MBq of 99m-Tc-pertechnetate (99mTcO4−), planar static images of the head, neck, and mediastinal regions were acquired. A focus of increased tracer uptake was noticed centrally in the region on the base of the tongue without uptake in the thyroid bed. By applying single-photon emission computed tomography/computed tomography (SPECT/CT) we confirmed the presence of lingual thyroid with tracer accumulation in the midline at the base of the tongue. In the follow-up appointments, the patient remained euthyroid. Further check-ups will be scheduled.
Conclusion: Although pertechnetate and iodine planar scans are usually employed to detect ectopic thyroid tissue, nowadays, the addition of SPECT/CT is an excellent tool for specific detection and confirmation of the lingual thyroid.

Key words: lingual thyroid, pertechnetate planar scan, SPECT/CT

BCNM-24/P26

^{18}FDG PET/CT IN THE DIAGNOSIS OF SECONDARY MALIGNANCIES IN PATIENTS WITH HODGKIN LYMPHOMA

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Introduction: The risk of a second cancer among patients who have been treated for Hodgkin's lymphoma is higher than the incidence of cancer in the general population. ^{18}FDG positron emission tomography / computed tomography (PET/CT) is used in the evaluation of a number of malignancies.
Case outline: A 62-year-old female patient was sent for an ^{18}FDG PET/CT examination at the Center for Nuclear Medicine with Positron Emission Tomography of the University Medical Center of Serbia for the initial staging of diffuse large B-cell lymphoma (DLBCL), diagnosed 19 years after the patient was being treated for Hodgkin lymphoma. PET/CT revealed an increased metabolism of glucose in a lesion in the right lower lobe of the lungs, which was previously seen on a standard-dose CT, and in the subcarinal lymph node. Bronchoscopy was performed, and a biopsy of the pulmonary lesion revealed squamous cell carcinoma. PET/CT examination also disclosed an increased accumulation of FDG in the right tonsil and right cervical lymph nodes, which showed an increased metabolism due to DLBCL, and a focal zone of an increased metabolism of glucose in the cervix, which still wasn't evaluated for malignancy at the time of this presentation.
Conclusion: PET/CT is a significant tool not only in the initial staging and follow-up of patients with lymphoma but also in a diagnostic evaluation of secondary malignancies, which these patients show an increased risk for.

BCNM-24/P27

ORPHAN RADIOPHARMACEUTICALS DRUGS IN US

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Introduction: On a global scale, there is no universally accepted definition of rare diseases, but essentially these are diseases that affect limited, small groups of the population. Orphan drug designation provides a drug developer with certain benefits and incentives, including a period of marketing exclusivity if regulatory approval is ultimately received for the designated indication, potential tax credits on U.S. clinical trials and waiver of certain administrative fees.
Methods and aims: Empirical study of orphan radiopharmaceuticals drugs within the US, registered respectively in "FDA Orphan Drug Designations and Approvals".
Results: Theranostics is a hot topic in the radiopharmaceutical market, especially due to the latest FDA approval of lutetium-177 dotatate to image and treat gastroenteropancreatic neuroendocrine tumours. This theranostic agent is a combination of a diagnostic agent and a therapeutic agent. Following the success of medicine as Lutathera, oncologists foresee that radioligand therapies will become a more prevalent modality in oncology.
The second trend is the emergence of targeted alpha therapies (TATs), exhibiting potential efficacy surpassing currently marketed beta therapies, as illustrated by the numerous ongoing clinical trials.
Conclusion: The US continues to have a leading role in the development and registration of orphan drugs. FDA orphan medicinal product designation is designed to promote the development of drugs that may provide significant benefit to patients suffering from rare, life-threatening diseases.

BCNM-24/P28

SENTINEL LYMPH NODE SCINTIGRAPHY IN CORRELATION WITH LACTATE DEHYDROGENASE IN PATIENTS WITH MALIGNANT MELANOMA

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Background: The sentinel lymph node, often referred to as the guardian lymph node, serves as the primary recipient of lymphatic drainage from a tumor. Consequently, detecting and pathologically examining the sentinel lymph node constitute crucial oncological procedures aimed at reducing the morbidity linked to extensive nodal dissection.
Objective: The goal of the study was to determine the connection between sentinel lymph node scintigraphy in patients with malignant melanoma and serum lactate dehydrogenase levels.
Methods and results: The research had the character of a retrospective study, encompassing 30 subjects with a histopathologically proven diagnosis of malignant melanoma. Following the initial surgical procedure, sentinel scintigraphy was performed to visualize the sentinel lymph node, with concurrent monitoring of LDH levels. Additionally, 30 subjects without a diagnosis of malignant melanoma were included in the study, with LDH monitoring. All participants were treated at the University Clinical Center Tuzla, Clinic for Plastic and Reconstructive Surgery, during the period from 2023 to 2024. In the group with a positive sentinel lymph node, there were 27 participants with reduced or normal LDH levels, while only 3 had elevated LDH levels.
In the group with a negative sentinel lymph node, there were a total of 24 participants with reduced or normal LDH values, while 6 had elevated LDH levels. The chi-square (χ^2) test did not establish a statistically significant dependence between the frequency of elevated LDH values and the sentinel lymph node (χ^2=0.52, P=0.47).
Conclusion: The occurrence of elevated LDH values and the presence of a sentinel lymph node are not associated phenomena.

Keywords: sentinel scintigraphy, malignant melanoma, LDH

BCNM-24/P29

ASSOCIATION BETWEEN SERUM TSH LEVELS AND VITAMIN D STATUS

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Background: Vitamin D deficiency is a global health problem. It is estimated that more than a billion people around the world have low concentrations of vitamin D, which is why it is rightly called a "pandemic" of vitamin D hypovitaminosis. Subclinical hypothyroidism characteristically presents with normal thyroxine (T4) levels and elevated thyroid stimulating hormone (TSH) levels.
Objective: We designed this study to determine whether there is a link between vitamin D levels and sensitivity to thyroid stimulating hormone and to provide a new perspective for studying the relationship between vitamin D and thyroid disease.
Methods and results : Our study included 103 patients. Serum levels of 25(OH)D and thyroid stimulating hormones (TSH) were measured. TSH levels with a given reference range of 0.27-4.2 mU/L, and serum vitamin D values with a given reference range of 75-200 nmol/L and 30-100 ng/mL were routinely determined for all participants.Vitamin D deficiency is established when serum values of this vitamin are below 75 nmol/l or below 30 ng/mL.
The Mann-Whitney test determined that vitamin D was statistically significantly lower in the group with elevated TSH than in the group of subjects with normal TSH values (Mann-Whitney U=1770, P=0.035, one-tailed test). Calculating Pearson's correlation coefficient, a statistically significant positive correlation was determined) vitamin D values in the group with elevated TSH values and those in the group with normal TSH values values (Pearson ρ=+0.324, P=0.018). All tests were performed with a significance level of 5% (P=0.005).
Conculsion: Our results indicated that patients with subclinical hypothyroidism suffered from hypovitaminosis D. Vitamin D is one of the hormones most influenced by seasonal variability; it is widely recognized that serum25(OH) vitamin D levels tightly correlate with sun expo-sure and seasonality. It can be proven that an underlying hypovitaminosis D may predispose subjects affected by subclinical thyroid disease to periodical worsening of theirthyropathy and require therapeutic intervention in some cases. During the winter period it is recommended not to start levothyroxine replacement therapy in patients with high TSH values. It is recommended to include vitamin D preparations in order to lower the TSH level.

Keywords: Vitamin D, thyroid stimulating hormone (TSH), deficiency

BCNM-24/P30

UNILOBAR GRAVES' DISEASE OF BILOBAR THYROID GLAND – A CASE REPORT

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Introduction: We report an extremely rare case of unilobar Graves' disease affecting only one of the thyroid lobes, with intact contralateral side.

Case report: A 19-year-old female patient, with Burkitt lymphoma (in remission since 2013), was referred at our department in 2015 due to rapidly growing right sided cervical mass, along with major symptoms of hyperthyreosis. The ultrasound examination revealed the right thyroid lobe enormously enlarged, diffusely hypoechogenic, highly hypervascularised, while the left lobe appeared small, isoechogenic and normally vascularised. No thyroid nodes or enlarged lymph nodes were noted. Thyroid scintigraphy with 99mTcO4- showed diffusely, three-fold enlarged right lobe, with preserved shape and extremely increased radioisotope uptake, along with shrunked, almost invisible left thyroid lobe. Graves' hyperthyroidism was confirmed biochemically: FT4 > 77,2 (11-25 pmol/L), FT3 = 38,6 (2.8-6.5 pmol/l), TSH < 0.07 (0.4-4.5 mIU/L), TRAB = 6.88 (0-1.5 IU/L) and aTPO = 875 (<35 kIU/L). Thyroid lymphoma with diffuse lobar spreading was excluded with fine needle aspiration biopsy of the right thyroid lobe. Euthyreosis and normalization of TRAB were achieved soon after the applied thyrostatic therapy.

Conclusion: Unilobar Graves' disease in bilobar thyroid gland is intriguing and may be explained by interlobar difference of TSHR cleavage, Na/I pump expression, lymphatic drainage or different influence of specific cytokine release. In everyday practice it presents diagnostic and therapeutic challenge for clinicians, when evaluating unilateral cervical masses and hyperthyroidism.

Keywords: Graves' disease, unilobar, hyperthyroidism, thyroid ultrasound, thyroid scintigraphy

BCNM-24/P31

PAPILLARY THYROID CARCINOMA ARISING FROM STRUMA OVARII

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Introduction: Struma ovarii (monodermal teratoma, dominantly or entirely consisting of thyroid tissue) is present in 2-5% of all teratomas. It is rarely diagnosed preoperatively, and in <5% of cases may become malignant.
Case presentation: A 34-year-old female patient, mother of two children, asymptomatic, was scheduled for an explorative curettage of uterine polyp and uterine adhesions (seen on US examination), followed by elective laparoscopic exploration and right adnexectomy, due to cystic right ovarian mass. The pathohistological evaluation confirmed the coexistence of struma ovarii (SO) and thyroid papillary carcinoma (TPC) in the cystic mass. No additional gynecological intervention was advised by the gynecologist. She was referred to our institute for TPC management. Normal thyroid morphology was detected on US, as well as thyroid function tests and hTg levels. With the patients' agreement, a total thyroidectomy was done, followed by radioiodine (I-131) ablative therapy. The whole body scan showed minor thyroid residual tissue in the neck, without local or distant metastasis. Being on TSH-suppressive doses of levothyroxine with undetectable levels of hTg, a condition of "low-risk patient" was achieved, allowing prediction of metastatic spreading in case of elevation of hTg.
Conclusion: Because of its rarity, the treatment of thyroid cancer in ovarian teratomas is not well-defined and should be considered individually, in consensus with the nuclear medicine specialist, gynecologist, oncologist, and patient.

Keywords: struma ovarii, papillary thyroid carcinoma, thyroidectomy, radioiodine ablation

BCNM-24/P32

^{99m}Tc MIBI MYOCARDIAL PERFUSION SCINTIGRAPHY AS A SCREENING METHOD FOR PREMATURE ATHEROSCLEROSIS IN ASYMPTOMATIC YOUNG PATIENTS WITH SYSTEMIC LUPUS ERYTHEMATOSUS

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Introduction. Systemic lupus erythematosus (SLE) is highly associated with premature and progressive atherosclerosis. Its early detection is of vital importance, considering the high occurrence rate for myocardial infarction, especially in younger patients.
Material and methods: Sixty female patients (pts.), Group I - $\leqslant$45y. (27/60 pts), and Group II - > 45 y. (33/60 pts.), with >5 y. duration of SLE, asymptomatic, severely burdened with traditional and SLE-related risk factors for atherosclerosis, underwent Rest-Dipyridamole ^{99m}Tc MIBI SPECT Myocardial perfusion scintigraphy (MPS), in order to detect and comparatively analyze potential perfusion abnormalities in the studied groups, in correlation with their risk profile for atherosclerosis.
Results: Abnormal MPS were equally prevalent in both groups (Group I - 44,4%; and Group II - 45.5%; p=ns). Both groups did not differ significantly concerning the extent, severity, and reversibility, as well summed scores (stress-SSS, rest-SRS, difference-SDS) of perfusion abnormalities (p=ns). Left-ventricular ejection fraction (LVEF) was normal in both groups (p=ns), but higher left-ventricular volumes (end-diastolic-EDV, end-systolic-ESV, and systolic-SV) during stress and rest conditions were detected in younger pts. (p<0,01). In the same group (I), higher SLEDAI score, and higher EDV at stress were identified as predictors of abnormal MPS, and more aggressive multidrug anti-SLE treatment as predictor of normal MPS.
Conclusion: Younger SLE patients with poorly controlled disease are in risk of accelerated atherosclerosis and should undergo screening for myocardial perfusion abnormalities using 99mTcMIBI MPS.

Key words: SLE patients, age, premature atherosclerosis, myocardial perfusion scintigraphy

BCNM-24/P33

INTRATHYROID THYMIC CARCINOMA (ITTC) AS AN INCIDENTAL FINDING AFTER THYROIDECTOMY DUE TO PAPILLARY THYROID CARCINOMA (PTC)

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Introduction: The coexistence of ITTC and PTC in the same thyroid is an extremely rare occurrence, with only a few cases reported globally.
Case presentation: A 46-year-old female with Hashimoto's thyroiditis, was referred for FNAB of newly-occurred thyroid nodules. Category III for the right thyroid nodule and category V for the left nodule were detected, and total thyroidectomy with lymphadenectomy was done. Pathohistological findings confirmed PTC in the left nodule, but were inconclusive in the right lobe nodule, with suspicion of poorly differentiated squamous carcinoma or ITTC. Additional immunohistochemical staining (CD5, CD117) finally confirmed the diagnosis of ITTC with metastatic spreading in the central neck lymph nodes (LN). I-131 ablation of the residual thyroid tissue was done, and the WBS detected a small amount of local thyroid tissue without local or distant metastasis. Soon after, levothyroxine TSH suppression and undetectable TG level were achieved. 7-months later US checkups detected bilaterally enlarged neck LN, with high metabolic activity (SUVmax.10-13,3) on the following PET. TG in FNAB needle-wash specimens was negative, but the cytological finding of malignant cells with epithelial origin was conclusive with relapse of ITTC. The patient was treated with radiotherapy by an oncologist, with complete regression of neck LN on control US and PET.
Conclusion: The coexistence of ITTC and PTC poses a diagnostic and therapeutic challenge that requires a multimodality approach for long-term follow-up.

Key words: intrathyroid thymic carcinoma, papillary thyroid carcinoma

BCNM-24/P34

ALLERGIC REACTION FOLLOWING THYROSUPRESSIVE AND BETA-BLOCKER THERAPY, CHALLENGES IN ELUCIDATION OF THE EXACT ETIOLOGY

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Introduction: A common beta-adrenergic receptor blocker, propranolol, has been linked to unfavorable cutaneous reactions on occasion. The start of hyperthyroidism treatment seldom presents with allergic reactions to the thyrosupressive drugs. We report a case of a patient with hyperthyroidism who experienced a cutaneous reaction to propranolol that was first misdiagnosed as an allergy to an antithyroid medication.

Case report: A 42-year-old woman with thyrotoxicosis appeared with an itchy rash on the face and both forearms three weeks after therapy with thiamazole and propranolol. Presuming an allergy to thiamazole, these medications were stopped, and corticosteroids and antihistamines were started. Because of the possible rash, propylthiouracil (PTU) was used as a thyrosupressive drug, and the beta blocker treatment (propranolol) continued. One week later, the patient developed a new cutaneous eruption. Erythematous papules with a grayish discoloration that occasionally converged into plaques on the lateral side of both forearms and discoid annular erythematous plaques were also visible on the forehead. Laboratory tests for rheumatic diseases were normal. Skin scratch tests were performed to prove or exclude PTU treatment, which is meaningful for further patient management. Surprisingly positive results were noticed for propranolol and thiamazole, while negative for PTU. The skin biopsy's findings indicated drug-induced maculopapular exanthems. Propranolol medication was stopped, and the condition's improvement was observed.

Conclusion: True identification of allergic reactions following thyrosupressive therapy is important because another drug such as a beta-blocker, may mimic these reactions, followed by cessation of the thyrosupressive drug in search of other treatment modalities.

Keywords: hyperthyroidism, thyrosuppresive therapy, beta-blocker, allergic reaction

BCNM-24/P35

DEVELOPMENT AND VALIDATION OF A HEADSPACE GAS CHROMATOGRAPHIC METHOD FOR THE DETERMINATION OF RESIDUAL SOLVENTS IN [^{18}F]FDG

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[^{18}F]FDG is the most widely used radiopharmaceutical for molecular imaging by positron emission tomography (PET). Fludeoxyglucose [^{18}F] injection is a sterile solution of fluorine-18 in the form of 2-deoxy-2-[18F]fluoro-α -D-glucopyranose, intended for intravenous administration. The quality control of [^{18}F]FDG produced at University Institute of Positron Emission Tomography is in accordance with quality requirements of EP monograph 01/2014:1325. Residual solvents is one of the post-release parameters applied on every produced batch. Considering the synthesis of [^{18}F]FDG injection, ethanol and acetonitrile occur as residual solvents. According to EP general chapter 5.4., ethanol is placed into Class 3 solvents with recommended concentration limit 5000 ppm, and acetonitrile is placed into Class 2 solvents with recommended concentration limit 410 ppm.
Headspace gas chromatographic method was developed and validated for the determination of ethanol and acetonitrile. Shimadzu gas chromatographic system GC-2010 plus was used, equipped with FID and head space injector HS-20. The method involved use of DB-624 column (30 m x 0,53 mm, 3 m) with split injection, temperature gradient elution with helium as carrier gas. Method validation was done by evaluating parameters as selectivity, linearity and range, detection limit, quantitation limit, precision and accuracy. The range of the method was evaluated from the Quantitation limit to the maximum allowed limit showing suitable accuracy and precision, and correlation coefficient above 0,99 for both, ethanol and acetonitrile.
This method was successfully applied for the quantitative determination of ethanol and acetonitrile in [^{18}F]FDG injection as a simple and reliable solution for routine analyses.

Keywords: [^{18}F]-fluorodeoxyglucose (FDG), gas chromatography, validation, headspace, residual solvents

BCNM-24/P36

SOFT TISSUE RETENTION OF ^{188}Re-HEDP

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Objective: The aim of the study is to present the affinity of in-house developed ^{188}Re-HEDP to bone and soft tissues, according the proposed indicator B/ST (bone/soft tissue) ratio, as a numerical expression of the relative accumulation (%ID/g) of the radiopharmaceutical in bone tissue in relation to the accumulation in soft tissues (muscle and blood).
Materials and methods: A biodistribution study was performed using the balb/c type mice injected with 30-50 Ci of ^{188}Re-HEDP in the tail vein. The animals were sacrificed at 10 min, 30 min, 1 hour, 3, 6, 24, 48 and 72 hours after application of the radiopharmaceutical. The radioactivity was measured simultaneously in all samples and the mean of the three animals for the respective time intervals was calculated. The distribution of radioactivity in the organs was calculated as a percentage of the total injected radioactivity per gram of tissue (%ID/g). The bone/muscle and bone/blood ratios of the corresponding %ID/g values were calculated in different time intervals of the biodistribution study.
Results: The values for bone/muscle and bone/blood (%ID/g) ratio showed that the bone/blood index reaches its peak at 24 hours after the application of the radiopharmaceutical. The index for bone/muscle ratio at 48 hours after the application is significantly reduced compared to the value at 24 hours, but after 72 hours it reaches a value greater than at 24 hours after the application of the radiopharmaceutical.
Conclusion: Based on the obtained results of the study, the ^{188}Re-HEDP complex has a selective affinity for bone tissue without significant soft tissue retention.

Keywords: soft tissues retention, radionuclide therapy, radiopharmaceuticals, Rhenium-188

BCNM-24/P37

HORSESHOE KIDNEY – BASIC DIAGNOSTIC METHODS

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Introduction: Horseshoe kidney is one of the most common types of renal fusion anomalies. In over 90% of cases, the kidneys are connected by their lower pole. The importance of this anomaly lies in the fact that these kidneys are more susceptible to trauma, and are a risk factor for the development of kidney stones and transitional cell carcinoma of the renal pelvis.
The aim of the work was to show what are the basic radiological and nuclear medicine diagnostic methods that can be used to diagnose horseshoe kidney.
Results and discussion: echosonography is the first diagnostic method that can suggest that it is a horseshoe kidney. A typical ultrasound finding is an abnormally rotated and inferiorly located kidney, poor visualization of the lower pole. Renal tissue located in front of the aorta can also be seen, which can be mistaken for retroperitoneal tissue in lymphoma or metastatic nodal enlargement.
A native image of the kidney shows the absence of visualization of the lower poles of the kidney, while the upper poles may be separated.
Intravenous urography shows the altered position of the renal cavities, the renal pelvises are anteposed, and the calyces are spatially oriented differently. The appearance of the calyces of the lower pole of the kidney is characteristic; they are directed medially, towards the spinal column.
Static kidney scintigraphy with 99mTc-DMSA is a useful diagnostic tool in diagnosing horseshoe kidney, clearly differentiating the functionality of the isthmus (renal parenchyma vs fibrous tissue). Horseshoe kidney can also be diagnosed as an incidental finding by numerous nuclear medicine examinations of other systems (skeleton scintigraphy, hepatobiliary scintigraphy).
Conclusion: Horseshoe kidney, as the most common renal fusion anomaly, is a risk factor for the development of kidney stones and transitional cell carcinoma of the renal pelvis.

Key words: horseshoe kidney, urography, kidney scintigraphy.

BCNM-24/P38

EVALUATION OF SUPERVISED MACHINE LEARNING RADIOMIC MODELS FOR PREDICTING FIVE-YEAR SURVIVAL IN HEAD AND NECK SQUAMOUS CELL CARCINOMA PATIENTS: AN EMPIRICAL ANALYSIS OF A PUBLICLY AVAILABLE DATABASE

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Medical imaging, a fundamental tool in clinical oncology and radionuclide therapy, offers non-invasive means for cancer diagnosis. Artificial intelligence (AI) has emerged as a transformative force in medical imaging field, enabling systems to learn and perform tasks without explicit programming. Within AI, machine learning (ML) and deep learning (DL) represent distinct instances, each harnessing data-driven methodology to mimic human intelligence. ML employs statistical techniques to enable learning from data, while DL utilizes multi-layer architectures for hierarchical abstraction. Radiomics, leveraging medical imaging data, enhances precision oncology by enabling personalized cancer care and capturing intra-tumor heterogeneity. This study evaluates four supervised ML classification methods (Support Vector Machine, Decision Tree, Random Forest and Extreme Gradient Boosting) to ascertain their efficacy in radiomics-based predictive analyses. Focusing on predicting five-year survival in Head and Neck Squamous Cell Carcinoma (HNSCC) patients (data publicly available from Anderson Cancer Center, Huston, Texas), this study provides a benchmark for future radiomics-based predictive research. In conclusion, this analysis contributes to advancing radiomics-based clinical predictions, emphasizing the importance of classifier selection and dataset-driven model optimization.

BCNM-24/P39

DIFFICULTIES AND INACCURACIES IN THE CYTOLOGICAL ANALYSIS OF FINE NEEDLE ASPIRATION THYROID BIOPSY: LESSONS LEARNED FROM CASE REPORTS

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Fine Needle Aspiration (FNA) biopsy is an essential method for diagnosing thyroid nodules. It provides a quick and cost-effective way to assess lesions for the presence of cancer. Nevertheless, the analysis of cytological discoveries presents intrinsic difficulties, which might result in potential mistakes that may affect the treatment of patients. This abstract presents a summary of the intricacies and challenges involved in cytological analysis by analyzing case reports. The difficulties in cytological examination of FNA thyroid biopsies involve multiple factors, such as the sufficiency of the sample, the appearance of the cells, and the criteria used for diagnosis.

The challenges of proper interpretation are posed by insufficient sample, cellular overlap, and the presence of uncommon subtypes of thyroid lesions. These cases demonstrate situations when there is a disagreement between the initial cytological diagnosis and the following histological investigation. This might result in the misclassification of lesions and improper therapeutic treatment. To summarize, although FNA biopsy continues to be a powerful diagnostic tool in thyroid disease, it is important to carefully assess the obstacles and errors that can arise in cytological analysis.

Case reports are highly important for learning purposes, as they provide insights into the intricate process of interpreting cytological samples and offer guidance on how to improve diagnostic accuracy and patient care when dealing with thyroid nodules.

BCNM-24/P40

PRIMARY HYPERPARATHYROIDISM FROM SCINTIGRAPHIC DETECTED MEDIASTINAL PARATHYROID ADENOMA

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Primary hyperparathyroidism is defined by elevated parathyroid hormone and calcium levels, most usually caused by a parathyroid adenoma. Parathyroid adenomas are most commonly detected in the neck, but also could be seen as an ectopic. Mostly of the ectopic parathyroid adenoma can occur in the mediastinum, rarely in thymus, or retro oesophagal area. We presented the example of a 73-year-old woman who was found to have hypercalcemia during a regular test. The patient's serum calcium (3.11 mmol/L), alkaline phosphatase (162 U/L), parathyroid hormone (PTH: 379 pg/mL) and creatinine (111.6 umol/L) levels were higher than the reference values. A chest computerized tomography scan revealed an anterior mediastinal mass, and nuclear scintigraphy revealed functioning parathyroid tissue in the mediastinum. The mediastinal parathyroid adenoma was effectively removed surgically, and the PTH level began to fall. As a conclusion we can say that any hypercalcemia and high PTH levels in the absence of a parathyroid adenoma in the neck should prompt clinicians to look for ectopic sites using a mix of imaging modalities.

Key words: hyperparathyroidism; parathyroid hormone, nuclear medicine scintigraphy

BCNM-24/P41

A CASE REPORT OF PATIENT WITH CHRONIC URTICARIA AND HASHIMOTO THYROIDITIS

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Introduction: Chronic urticaria (CU) is defined as recurrent episodes of urticaria, at least twice a week, occurring for six weeks. Hashimoto thyroiditis (HT) or autoimmune hypothyroidism is the most common cause of hypothyroidism and is characterized by the production of thyroid autoantibodies against thyroid peroxidase and thyroglobulin. There is an increased association between HT and CU.
Aim: We present a case of a patient suffering from CU and newly diagnosed Hashimoto thyroiditis in which levothyroxine therapy completely resolved the symptoms of urticaria.
Case: A 40 year-old female with a medical history of recurrent urticaria almost 3 months, presented also with fatigue, weight gain, constipation and loss of concentration. The CU is not improved with antihistamines and change in nutrition. All alergological and all other hematological tests are in normal range, except present of hyperholesterinemia. Laboratory investigations showed a high thyroid stimulating hormone (TSH) level and a low free thyroxin (FT4) level. She had elevated levels of antithyroid peroxidase (anti-TPO) and anti-thyroglobulin antibodies (anti-TG). Based on investigations, she was diagnosed as a Hashimoto's thyroiditis and started therapy with levothyroxine, first 50 mcg per day and the dose raised to 100 mcg per day in 4 month period to achieve euthyroid levels. She noticed that her uncontrolled recurrent urticaria started to get better, and after six months of levothyroxine therapy, she stopped taking her topical ointments and antihistamines that she had been using for urticaria. She is on regular follow-up every six months for the last two years and she is symptom-free.
Discussion: We reported a case of a patient in which levothyroxine therapy completely resolved the symptoms of chronic urticaria. The reason for the association between positive serological tests for thyroid autoimmunity and CU is unclear. A cross-linking of IgE receptors of mastocytes induced by antithyroid antibodies may be a cause of histamine release. Thyroid hormonal therapy, mainly by TSH suppression, can reduce the symptoms of CU in a patient with Hashimoto thyroiditis. The resolution of chronic urticaria with levothyroxine in our patient with Hashimoto thyroiditis suggests a common underlying mechanism between the two pathologies. But more studies are needed before a strong recommendation for levothyroxine as a treatment for CU in patients can be made.

Keywords: chronic urticaria, Hashimoto thyroiditis, levothyroxine

BCNM-24/P42

CANDIDA ESOPHAGITIS DETECTED BY 18F-FDG PET/CT IN PATIENT WITH HODGKIN LYMPHOMA

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Esophageal 18F-FDG uptake in oncologic patient is challenging and not so rare. It may represent normal physiological uptake, inflammation, infection or neoplasia. Esophageal cancer frequently causes a focal intense FDG uptake on PET/CT scan with high SUV, while esophagitis often result in a diffuse mild to moderate degree of FDG activity with lower SUV.

We present a case of 42 year old male patient with a diagnosis of Hodgkin lymphoma, stage IV, confirmed also with preterapeutic or initial PET/CT. After 4 cycles of chemotherapy under ABVD protocol and corticosteroids, that are comomonly used in lymphoma patients, on interim PET/CT we found mild regresion of lymphoma (Deauville score IV) and also diffuse mild FDG uptake in esophagus, with low SUV. Patient had problem with low apetit and dysphagia. Endoscopy confirmed Candida esophagitis and anti fungal therapy was prescribed.

Candida esophagitis is the most common infection of the esophagus and has generally been attributed to as a complication of immune suppressed state and uses of corticosteroids. Esophageal candidiasis can be misdiagnosed as malignancy and may lead to difficulties while managing these patients.

Keywords: 18F-FDG PET/CT, Candida esophagitis, Hodgkin lymphoma

BCNM-24/P43

MYXEDEMATOUS COMA – A CASE REPORT

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A 58-year-old female patient was hospitalized in life threatening medical condition, under a working diagnosis of cerebral infarction. She was comatose, obese, and in severe anasarca. Initial laboratory tests and examinations performed in the first 24 hours indicated myxedematous coma, adjoined by acute kidney failure with rhabdomyolysis, dehydration, hypotension and hepatic failure, followed by hypercortisolemia as a stress reaction (TSH=78.73mIU/L; fT4=1.3pmol/L, Serum Creatinine 255umol/L, Urea 22.1mmol/L, AST 121/U/L; ALT 84U/L, Creatine Kinase 1365U/L, LDH 556U/ , Cortisol 1756 nmol/L). Lungs X-ray - myopathic heart. Abdominal echo – flatulence and intestinal arest. Due to unavailability of i.v. formation of levothyroxine in Macedonia, it was immediately ordered and arrived in less than 48 hours. During the first two days, the tablets were crushed and administered in a nasogastric tube, but there was no resorption of the applied drugs. In the first 12 hours of the hospitalization, the general condition worsened with agonal breathing, peripheral saturation of 40% and electrolyte imbalance. In the following days, the patient became dependent on catecholamine support, with a significant drop in platelets and calcium. The free thyroxin levels in the blood initially marginally improved, but then despite the application of i.v. formation of levothyroxine, there was no significant increase in the fT4 levels. An acidosis with a pH of 6.9 occurred, a drop in blood elements, as well as a disruption of the coagulation system, during which exitus lethalis occurred, all in all 12 days after admission.

BCNM-24/P44

MEDULLAR THYROID CARCINOMA IN A PATIENT WITH HYPERTHYROSIS

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Introduction: Thyroid carcinomas are rare, accounts for < 1% of all cancers. Medullary thyroid carcinoma originates from parafollicular C cells of the thyroid gland that produce calcitonin and leads to elevated calcitonin levels, which is an essential feature of this carcinomas. Medullary thyroid carcinoma accounts for 5-10% of all thyroid carcinomas and based of RET mutation analysis occurs in two forms: sporadic (85%) and familial (25%) in multiple endocrine neoplasia (MEN types 2A or 2B).
Case report: We present a 50-year-old female patient with thyrotoxicosis diagnosed 6 months ago, who comes to our clinic with symptoms of facial redness, diarrhea and weight loss. The patient was on therapy with thiamazole 20 mg per day. We made a ultrasound of thyroid gland (Thyroid gland slightly hypoechoic, inhomogeneous with hypoechoic zones, richly vascularized. In the right lobe, an inhomogeneous nodule measuring 8.7x5.9x7.8 mm with peripheral vascularization). From laboratory finding: TSH-10.47 mU/l, fT4-11.85 pmol/l, ATPO-71, hTG-1.14 ng/ml Calcitonin-119.3 pg/ml. Due to the high values of calcitonin and the suspicious ultrasound findings, the patient underwent a fine needle aspiration biopsy of the node in the right lobe. The cytological finding was in addition to the third classification group (benign hurtle cell adenoma in which the hurtle cells show atypia).
The patient was sent for a right-sided lobectomy. The pathohistological finding was medullary carcinoma of the thyroid gland and the patient was sent for total thyroidectomy. The patient had a good operative and postoperative course. Postoperative calcitonin and thyroglobulin levels were unmeasurable and the patient was placed on levothyroxine therapy. The patient underwent a CT scan of the neck, X-ray of the lungs and ultrasound of the abdomen, without any distal metastases of the disease. One year after operation we performed a PET/CT diagnostic with normal finding.
Discussion: Calcitonin is an important serum biomarker for the diagnosis of medullary thyroid carcinoma as well as for prognosis and survival after surgery. Most patients come for an examination because of a lump in the neck area, but the symptoms caused by the systemic effects of calcitonin (flushing/diarrhea) should not be ignore, because it can lead to an early diagnosis of the disease.
Conclusion: Medullary thyroid carcinomas are aggressive, with rapid propagation in the surrounding lymph nodes and tissues. The prognosis is good, if the tumor is localized only in the thyroid gland at the time of diagno

BCNM-24/P45

THE EFFECT OF THYROID AUTOANTIBODIES ON DYSLIPIDEMIA IN PATIENTS WITH MILD FORM OF SUBCLINICAL HYPOTHYROIDISM

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Introduction: Increased incidence of dyslipidemia was found in patients with subclinical hypothyroidism (ScH) with positive anti-TPO antibodies. However, there are no studies which evaluate the effect of thyroid substitution therapy on lipids in these patients.
Aim: To evaluate the effect of the presence of anti-TPO antibodies on lipid parameters in patients with mild form of ScH treated with levothyroxine.
Materials and methods: Fifty-seven patients with newly diagnosed subclinical hypothyroidism (ScH) and thyroid-stimulating hormone (TSH) levels below 10 mIU/L, who met the treatment criteria, were included in the study. Lipid parameters and anti-TPO antibodies were evaluated at the first visit and only lipids after 5 months euthyroid stage.
Results. The average value of TSH in patients was 8.1 ± 1.9 mIU/L. The euthyroid state was achieved with a mean dose of 60.8 ± 19 μg in a mean durat ion of 7.5 ± 2.2 months. Thyroid substitution therapy significantly decreased total cholesterol and LDL-C, and increased HDL-C. TSH positively correlated with total cholesterol ($r = 0.147$, $p < 0.05$), and FT4 statistically significantly positively correlated with HDL-C ($r = 0.197$, $p < 0.05$). The lipid parameters did not respond to L-T4 treatment in patients with negative anti-TPO antibodies, while a decrease in total cholesterol, total cholesterol/HDL-C, and LDL-C/HDL-C was observed in patients with positive anti-TPO antibodies.
Conclusion: Patients with mild ScH and positive anti-TPO antibodies with high cholesterol levels may benefit from thyroid substitution therapy.

Keywords: subclinical hypothyroidism, dyslipidemia, thyroid autoantibodies, thyroid substitution therapy

BCNM-24/P46

UNCOMMON ^{18}FDG AVID SOFT TISSUE AND LIVER LESIONS IN NECROBIOTIC XANTHOGRANULOMA: A CASE REPORT

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Introduction: Necrobiotic xanthogranuloma (NXG) is a rare chronic granulomatous disorder primarily affecting the skin but with known extracutaneous involvement. It is associated with monoclonal gammopathy, predominantly IgG, and may progress to hematologic malignancies. We report a case of NXG in a 53-year-old patient with IgG paraproteinemia presenting with atypical ^{18}FDG PET/CT findings.

Case report: The patient had a history of monoclonal gammopathy of unknown significance (MGUS) and later developed NXG, characterized by skin lesions and treated with corticosteroids. Clinical suspicion of multiple myeloma prompted a PET/CT scan revealing metabolic activity in cutaneous, subcutaneous, and intramuscular lesions consistent with NXG. Additionally, metabolic activity was observed in liver lesions, possibly inflammatory or malignant, raising concern for extracutaneous involvement.

Conclusion: This case illustrates the diverse manifestations of NXG and emphasizes the significance of recognizing atypical presentations, such as ^{18}FDG avid soft tissue and liver lesions, in patients with this condition.

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^{18}F-NAF- PET/CT VS ^{18}F-FDG-PET/CT IN DETECTING BONE METASTASIS

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Introduction: Bone is a common metastatic site in patients with malignancy.The early diagnosis of bone metastases is significant for initial staging and treatment planning. Hybrid imaging modalities like positron emission computed tomography(PET/CT) systems are crucial in diagnosis, staging and monitoring of treatment in cancer patients. **Aim**:In this study we are comparing bone findings with ^{18}F-FDG-PET/CT vs^{18}F sodium-fluoride (NaF)PET/CT, exploring which cancer patients could benefit from improving diagnostic accuracy for detecting bone metastasis.
Materials and methods:^{18}F-NaF-PET/CT scan was performed in 10 oncological patients with histopathologically different types of malignant cancers that were suspected for bone metastasis. All of them had inconclusive findings or low metabolic bone lesions on the previously performed ^{18}F-FDG-PET/CT scan.
Results: In 7 patients with suspicious low metabolic bone lesions on ^{18}F-FDG-PET/CT, we excluded bone metastases using ^{18}F-NaF-PET/CT. In one patient with moderate metabolic activity of the spine, multiple bone metastases were detected on ^{18}F-NaF-PET/CT. In one patient with two bone lesions with high SUV on ^{18}F-FDG-PET/CT scan, multiple bone metastases were shown on ^{18}F-NaF-PET/CT. In 1 patient, the ^{18}F-NaF-PET/CT scan revealed a bone lesion with high metabolic activity located in C3, suspicious for bone metastasis, which was not shown on the previous ^{18}F-FDG-PET/CT.
Conclusion: In this study we emphasize the clinical value of ^{18}F-NaF-PET/CT for early diagnosis of bone metastases in comparison to ^{18}F-FDG-PET/CT, which can change the treatment and clinical outcome for oncological patients. The limitation of the study was the small number of included patients. Further analysis including a large number of evaluated patients could help in revealing which category of cancer patients would benefit most from the use of ^{18}F-NaF-PET/CT scan.
Keywords: bone metastases,^{18}F-FDG-PET/CT, ^{18}F-NaF-PET/CT.

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PLANAR IMAGING AND HYBRID SPECT/CT IN PRIMARY MELANOMA LYMPHOSCINTIGRAPHY: A SINGLE-CENTER ANALYSIS

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Sentinel lymph node (SLN) biopsy is the standard of care for nodal staging in cutaneous melanoma patients. Hybrid single photon emmision computed tomography/computed tomography (SPECT/CT) can provide important information to surgeon performing SLN biopsy.
Our goal was to present 15-year results of SLN biopsy at our Institution.
METHOD We have analyzed clinicopathologic and lymphoscintigraphic characteristics in 420 patients melanoma patients who underwent SLN biopsy between 2010 and 2019. Additionaly we report our initial experience in (SPECT/CT) lymphoscintigraphy.
RESULTS: Detection rate of SLN was 97.1%, by planar lymphoscintigraphy (PL). Metastases were found is 18.8%. Male gender, primary-tumor thickness with nodular histology, acral location, presence of ulceration and the number of nodes harvested, were significantly associated with SLN status.
SPECT/CT was performed after PL in 38 patients (30 patients with head and neck melanoma and 8 patients with trunck melanoma). The detection rate of SLNs in head and neck melanoma patients was 93.3%. SLN was not found in two patients. In total 58 lymph nodes were harvested (2.07 per patient). Hystopathology revealed metastases in 11% (3/28) patients. There were no patients with SLN seen only on SPECT/ CT.
CONCLUSION In addition to the well-established primary tumor thickness as a predictor of SLN positivity, we observed acral location and nodular melanoma subtype to significantly enhance the risk of metastases in SLN.
Surgeons found routine use of SPECT/ CT lymphoscintigraphy in head and neck melanoma patients very useful , especially when SLN is visualized close to the facial nerv or the parotid gland.


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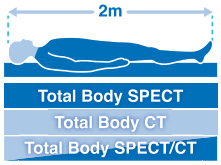

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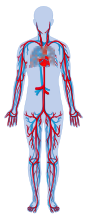

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