HEMATOLOGY, TRANSFUSION AND CELL THERAPY

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RELATO DE CASOS - 2° CONGRESSO CANCERTHERA EM CONJUNTO COM O 18° SIMPÓSIO EDWALDO CAMARGO

PRODUCING IODINE-131 FROM TELLURIUM-130 NEUTRON ACTIVATION: STUDY OF FEASIBILITY IN THE ARGONAUTA RESEARCH REACTOR AT IEN

LUCIANA CARVALHEIRA [a],
Ramon Matias Nunes MENDONÇA [b],
Francisco José de Oliveira FERREIRA [a],
Rogerio Chaffin NUNES [a]

[a] *Instituto de Engenharia Nuclear, Rio de Janeiro, RJ, Brazil*
[b] *Universidade Federal do Rio de Janeiro (UFRJ), Rio de Janeiro, RJ, Brazil*

A B S T R A C T

Introduction/Justification: Modern oncology faces challenges when treating elderly patients, who often have limited responses to conventional chemotherapy. To address this, theranostics combines diagnostic and therapeutic properties of radioisotopes in the same molecule, enabling personalized medicine. Iodine-131 (I-131) is a pioneering theranostic radionuclide widely used in Nuclear Medicine, for thyroid cancer due to its high affinity for thyroid tissue and beta and gamma radiation emission. In Brazil, the production and supply of I-131 are managed by the Nuclear and Energy Research Institute (IPEN) in São Paulo. However, delivering short-lived radioisotopes to remote regions presents challenges that may cause delays, affecting clinical and research applications. This highlights the need for alternative production methods to ensure timely availability of crucial radionuclides. This study explores the feasibility of producing I-131 through neutron activation of tellurium-130 at the Argonauta Research Reactor at the Nuclear Engineering Institute (IEN) in Rio de Janeiro. The Argonauta reactor, in operation since 1965, has been used for R&D in nuclear technology and the training of human resources for Brazil's Nuclear Program. Its team has optimized I-131 synthesis from tellurium-130 via neutron activation. The reactor's Nuclear Instrumentation and Radiochemistry laboratories are equipped for radiochemical processing, purification, and gamma spectrometry. Developing a validated I-131 production method at IEN would benefit local research and reduce dependence on external suppliers. **Report:** In the methodology, high-purity tellurium dioxide (TeO2) was irradiated for one hour at a neutron flux of 10^9 n/cm^2·s. After irradiation, I-131 was isolated using a radiochemical separation process. The irradiated oxide was dissolved in sodium hydroxide solution (4 mol/L), followed by hydrochloric acid (1 mol/L) addition to adjust the pH to 5-6. The separation method ensured I-131 retention in the aqueous phase. Gamma spectrometry confirmed radionuclide half-life, radionuclidic purity, and activity levels. The results demonstrated successful I-131 production with radionuclide purity over 95% within four hours post-irradiation. The highest activity was observed approximately 10 hours after neutron activation. Decay curve analysis confirmed the expected half-life of 8.025 days, consistent with literature values. The study also highlighted the efficiency of the radiochemical separation method in minimizing contamination from tellurium-131. **Conclusion:** These findings indicate that the proposed method is a viable alternative for local I-131 production, particularly for research purposes. While the activity levels achieved are suitable for experimental applications, further optimizations, such as increasing neutron flux, extending irradiation time, or improving chemical processing efficiency, may be required to meet higher activity demands in nuclear medicine. Future work will focus on refining the process to scale up production while maintaining the stringent purity and safety standards needed for medical applications. The successful implementation of this technique could provide a reliable and accessible source of I-131 within Brazil, benefiting the scientific community.

Keywords: Argonauta reactor, Iodine 131, Neutron activation, Tellurium.

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PSMA PET/CT FOR DETECTING BRAIN METASTASIS IN ESOPHAGEAL CANCER: A CASE REPORT

FABÍOLA FURTUOSO ZARPELÃO [a],
Renata Erbert CONTRICIANI [b],
Caroline TORRICELLI-CORRÊA [b],
Natália TOBAR [b],
Larissa Ariel Oliveira CARRILHO [b],
Leo Victor KIM [b], Luiz Roberto LOPES [b],
Nelson Adami ANDREOLLO [b],
Maria Carolina Santos MENDES [b],
Elba Cristina Sá de Camargo ETCHEBEHERE [b],
José Barreto Campello CARVALHEIRA [b]

[a] *Universidade Estadual de Campinas (UNICAMP), Paulínia, SP, Brazil*
[b] *Universidade Estadual de Campinas (UNICAMP), Campinas, SP, Brazil*

A B S T R A C T

Introduction/Justification: PET/CT with prostate-specific membrane antigen (PSMA) has been investigated in various scenarios beyond prostate cancer, with PSMA expression reported in multiple solid tumor tissues, including their neovascular endothelium.[1] We present the case of a patient with esophageal cancer who developed brain metastasis, emphasizing the critical role of 18 F-PSMA PET/CT imaging in detecting metastatic lesions and its potential impact on guiding treatment strategies. **Report:** G. H. B., a 71-year-old Brazilian male with a history of smoking, alcohol consumption and gastroesophageal reflux disease, was diagnosed with esophagogastric adenocarcinoma in 2024. 18 F-FDG PET/CT staging revealed a localized neoplasm at the esophagogastric junction (6.4 cm, SUV=15.1) and regional paratracheal lymphadenopathy (SUV = 17.2), with no evidence of distant metastasis. The patient initiated neoadjuvant chemotherapy with the FLOT regimen (fluorouracil, leucovorin, oxaliplatin, and docetaxel) and after four cycles, he underwent 18 F-FDG and 18 F-PSMA PET/CT. 18 F-FDG PET/CT revealed disease progression with increased primary lesion metabolic activity, new paratracheal lymphadenopathy and a right temporal lobe lesion consistent with metastasis. In comparison, 18 F-PSMA PET/CT showed higher 18 F-PSMA uptake in the temporal lobe lesion, similar uptake in the distal esophagus, and reduced uptake in the mediastinal lymph nodes. The multidisciplinar team contraindicated esophagectomy, recommending radiotherapy for the central nervous system metastasis over neurosurgery, and palliative systemic treatment. **Conclusion:** To our knowledge, this is the first reported case of brain metastasis from esophageal cancer identified using 18 F-PSMA PET/CT. The increased 18 F-PSMA uptake in the brain lesion, compared to 18 F-FDG PET/CT, may be attributed to PSMA overexpression in the neovascular endothelium of non-prostate cancers.[2] 18 F-PSMA PET/CT represents a novel diagnostic tool for non-prostate cancers, potentially offering higher sensitivity for detecting brain metastases than 18 F-FDG PET/CT. Further clinical trials are warranted to investigate its role in gastrointestinal malignancies.

Keywords: 18 F-PSMA PET/CT, Brain metastasis, Esophageal cancer.

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"ARMADILHA" NA ESTRATÉGIA DA RADIOEMBOLIZAÇÃO HEPÁTICA COM ÍTRIO90 NAS METÁSTASES DE CARCINOMA DE CÓLON. RELATO DE CASO

MARCIA GARRIDO MODESTO TAVARES,
Ingrid Guiname BLOISE,
Mariana Ramos FERNANDES CAMACHO,
Jose Geraldo ALMEIDA FILHO,
Irene shimura ENDO, Fabiana Lucas BUENO

IBCC/UDDO, São Paulo, SP, Brasil

R E S U M O

Introdução/Justificativa: O câncer colorretal é a segunda causa de morte relacionada ao câncer no mundo. Aproximadamente metade dos pacientes apresenta metástase hepática ao diagnóstico ou no curso do tratamento. A ressecção cirúrgica com intenção curativa contempla apenas 20% dos casos. A maioria é considerada irressecável, sendo submetida a tratamento sistêmico. A radioembolização interna seletiva (SIRT) com microesferas de ítrio90 tem desempenhado importante papel na estratégia terapêutica das metástases hepáticas por câncer de cólon com aumento da sobrevida livre de progressão. **Relato:** Este é o caso de um homem de 54 anos, submetido a cirurgia por obstrução intestinal em agosto de 2022, com diagnóstico de adenocarcinoma de cólon direito já com metástases hepáticas. Iniciou quimioterapia sistêmica (QT) e após progressão hepática, iniciou segunda linha de QT no início de 2023. O estudo de PET/CT evidenciava quatro lesões no lobo direito e uma lesão no segmento IVa, sem evidência de doença extra-hepática e pequena área de dilatação biliar associado a diminuto foco de captação no segmento II. A RNM apresentava os mesmos nódulos e referia pequena dilatação biliar no segmento II, sem caracterização de fator obstrutivo. Paciente foi submetido a radioembolização hepática com itrio90, com excelente concentração nas 5 lesões hepáticas secundárias. Foi administrado itrio90 seletivamente no segmento IVa (maior lesão, 0,4 Gbq correspondendo pelo Partition a 200Gy no tumor), segmento VI (0,4Gbq com 200Gy nas duas lesões), e de forma não seletiva no tronco que irrigava os segmentos V/VIII e VI/VII (1,0 Gbq). Optou-se por não abordar

a mínima área de dilatação biliar no segmento II devido à ausência de lesão na RNM. Paciente evoluiu bem, PET/CT realizado 3 meses após o tratamento mostrou resposta excelente na lesão do segmento IVa, resposta completa nas outras 4 lesões, porém crescimento significativo das dimensões e captação da lesão associada a dilatação biliar no segmento II não tratado. Encaminhado para radioablação da lesão remanescente. A RNM 3 meses após, apresentava ausência de doença hepática ativa, significativa redução das dimensões do lobo hepático direito e hipertrofia do lobo caudado e lobo esquerdo. Teve férias da QT por 6 meses quando foi evidenciado nova progressão de doença hepática associado a obstrução biliar e doença secundária pulmonar, sendo submetido a procedimento de drenagem biliar e reiniciado tratamento sistêmico. **Conclusão:** O sucesso do tratamento locorregional das metástases hepáticas no câncer de cólon está relacionado a um bom planejamento e entrega do itrio90 nas lesões. O caso descrito nos ensina que houve boa resposta ao itrio90 nas áreas tratadas, que focos pequenos de doença merecem atenção pois podem ser os vilões no futuro e que o PET/CT foi mais sensível na detecção precoce de lesão hepática pequena ávida a glicose. Nosso paciente superou a expectativa média de vida de 14 meses para pacientes metastáticos, ficando 15 meses sem progressão após SIRT e radioablação, com boa qualidade de vida e ganhando férias de quimioterapia. Apresentou recidiva apenas em áreas não tratadas. A armadilha pode estar nos pequenos focos de doença!

Palavras-chave: Cancer de cólon metastático, Evolução pós radioembolização hepática com itrio90, Radioembolização com itrio90;.

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CASE REPORT OF METASTATIC MELANOMA LESION AFFECTING AN EXTENSIVE AREA OF THE LEFT LOWER LIMB ON 18F-PSMA PET/CT AND 18F-FDG PET/CT IMAGES – INTENDING TO COMPARE THE DISTRIBUTION OF BOTH RADIOTRACERS IN THIS CANCER

LARISSA MANSANO DE SOUZA,
Thiago Soares Rocha ALVES,
Diego Machado MENDANHA, Ellen LIMA,
Natália TOBAR, Juliana P SOUZA,
Ligia Traldi MACEDO, Allan Oliveira SANTOS,
Mariana Cunha Lopes de LIMA,
Elba Cristina Sa de Camargo ETCHEBEHERE,
Carmen Silvia Passos LIMA

Universidade Estadual de Campinas (UNICAMP), Campinas, SP, Brazil

A B S T R A C T

Introduction/Justification: Positron emission tomography (PET/CT) using 18F-FDG has been widely used for staging and monitoring melanoma patients. Recent studies highlight the potential of 18F-PSMA PET/CT as an additional diagnostic modality, given the expression of prostate-specific membrane antigen (PSMA) in melanoma cells. Recent evidence indicates that anti-PSMA antibodies react with malignant melanoma neo vasculature, coupled with incidental findings reporting PSMA avidity in melanoma, the potential role of 18F-PSMA PET/CT as a novel diagnostic imaging technique in non-prostatic cancers looks promising. **Report:** We describe below a case that illustrates the potential of 18F-PSMA PET/CT in evaluate melanoma lesions: 72-year-old female patient, Caucasian, single, with medical history of chronic obstructive pulmonary disease, diabetes mellitus, hypertension, smoking for 10 years (50 pack-years), and a cerebral aneurysm clipping in 2013 (which resulting in inability to walk). In 2022, she developed a sudden and progressive lesion on her left hallux, which spread to left lower limb over six months. She underwent two biopsies, confirming the diagnosis of melanoma. In 2024, the subject presented on physical examination a lesion affecting all the posterior portion of the lower limb, associated to an ulcerated vegetative lesion of approximately 10 cm on the medial portion of the left hallux. The immunohistochemistry findings described an invasive and ulcerated melanoma (Breslow 5 mm). On 16-October-2024 she underwent a 18F-FDG PET/CT founding an extensive densification of the subcutaneous tissue throughout the entire left lower limb, associated with multiple nodules, measuring up to 6.8 × 3.2 cm (SUVmax = 36.9). Furthermore, it was found left inguinal and femoral lymphadenopathy, and multiple pulmonary and hepatic nodules (SUVmax = 30.3). On the following day (17-October-2024), it was performed a 18F-PSMA PET/CT which found uptake of the radiotracer on the primary lesion in the left lower limb (SUBmax = 22.7), in the regional lymph nodes (inguinal and femoral) and pulmonary nodules (SUVmax = 32.1). Comparatively, the 18F-PSMA radiotracer showed smoothly less intense uptake in the left lower limb lesion and pulmonary nodules compared to 18F-FDG. On the other hand, hepatic nodules did not present 18F-PSMA uptake, while 18F-FDG uptake was moderately intense (SUVmax = 9.7). Due to the patient's multiple comorbidities, advanced age, poor general condition (Karnofsky Performance Status of 40%), and high surgical risk, invasive treatment was contraindicated. Palliative care was chosen instead. **Conclusion:** Therefore, apart from the use of 18F-PSMA PET/CT in staging of prostate cancer patients, this method shows a great potential in the evaluating of metastatic melanoma, with a capacity of uptake in lesions comparable to 18F-FDG PET/CT (as demonstrated in this case), needing further and longer studies to confirm these advantages.

Keywords: FDG PET/CT, melanoma, PSMA PET/CT.

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MESENCHYMAL PHOSFATURIC TUMOR: A CASE REPORT OF SUCCESS

GARDENIA BARBOSA [a], Natália TOBAR [a],
Monique OHE [b], Karina ARAUJO [c],
Maurício ETCHEBEHERE [d,e],
Elba ETCHEBEHERE [a,d]

[a] *Division of Nuclear Medicine, Universidade Estadual de Campinas (UNICAMP), Campinas, SP, Brazil*
[b] *Department of Endocrinology and Metabology, Escola Paulista de Medicina da Universidade Federal de São Paulo (EPM/UNIFESP), São Paulo, SP, Brazil*
[c] *MULTIPAT Laboratory, Campinas, SP, Brazil*
[d] *Medicina Nuclear de Campinas – Grupo MND, Campinas, SP, Brazil*
[e] *Department of Orthopedics, Rheumatology and Traumatology, Universidade Estadual de Campinas (UNICAMP), Campinas, SP, Brazil*

A B S T R A C T

Introduction/Justification: Hypophosphatemia mesenchymal tumors (HMT) are rare, of uncertain origin, and may cause osteomalacia derived from paraneoplastic syndrome. The clinical manifestations are caused mainly by phosphatase secretion promoted by the tumor cells, leading to excessive kidney excretion of phosphate, fractures, bone pain, hypophosphatemia, and low calcitriol levels. HMTs are challenging to locate through anatomic imaging because they are relatively small and occult. **Report:** We describe a case that illustrates the potential of nuclear medicine to identify HMT. A 52-year-old female patient complained of diffuse pain, especially in the hips, rib cage, and feet, for over one year. Magnetic resonance imaging (MRI) of the hip demonstrated bilateral avascular necrosis of the femoral heads. To evaluate a possible osteometabolic alteration, such as hyperparathyroidism, she underwent bone scintigraphy, which did not reveal signs of hyperparathyroidism but identified (in addition to the avascular necrosis) signs of hypertrophic osteoarthropathy, suggesting paraneoplastic syndrome. Laboratory tests showed normal PTH, hypophosphatemia, and phosphaturia. The patient initiated oral phosphorus replacement, which only partially reduced bone pain. She was submitted to an FDG-18F PET/CT to search for an occult tumor, which was negative. Considering the patient's phosphaturia and reports of hypophosphatemia and osteomalacia caused by occult non-mesenchymal tumors of the soft tissues, the hypothesis of phosphate-producing HMT was considered. These tumors arise mainly in the lower limbs, generate pain and a predisposition to small fractures in subchondral bones (more common in the femoral heads), and express somatostatin receptors. Thus, a DOTATATE-68Ga PET/CT was performed to locate this somatostatin-expressing occult tumor. The images showed a 0.5 cm intramuscular nodule with hyperexpression of somatostatin receptors deep within the left thigh muscle. To prepare for surgery, an MRI of the left thigh was performed to locate the nodule with DOTA-68Ga uptake. MRI showed the nodule was quite deep within the muscle and close to the left femoral vascular-nerve bundle. Due to the lesion's small size, deep location, and proximity to the neurovascular bundle, radioguided surgery with DOTA-68Ga was performed to remove the nodule. Histopathology concluded the nodule was consistent with a hypophosphatemia mesenchymal tumor. After the removal of the tumor, the phosphate level normalized, the pain disappeared, and the patient reported improved physical and mental health. **Conclusion:** In conclusion, a bone scan was essential to identify the possibility of an occult tumor due to the imaging characteristics of paraneoplastic syndrome, and the DOTATATE-68Ga PET/CT was vital to locate the tumor.

Keywords: Case report, DOTATATE-68Ga, Mesenchymal phosfaturic tumor, Osteomalacia.

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