information for monitoring patients and combining therapies, especially as PSMA PET/CT demonstrated more extensive disease. PSMA PET/CT has the advantage of the possibility of a Theranostic approach.

Keywords: Musculoskeletal tumors, PET FDG, PET PSMA, Theranostic.

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EVALUATION OF METABOLIC QUANTITATIVE VARIABLES AND QUALITATIVE/VISUAL PET/CT IN PATIENTS WITH RECTAL CANCER WHO ACHIEVED COMPLETE AND INCOMPLETE RESPONSE AFTER NEOADJUVANT RADIOCHEMOTHERAPY

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Introduction/Justification: Patients diagnosed with advanced rectal cancer (RC) are often submitted to neoadjuvant chemoradiotherapy (NACRT) treatment. There is no ideal imaging tool to measure the response of tumor after treatment. **Objectives:** The aim of this study was to evaluate the metabolic parameters obtained by FDG PET/CT, before and after NACRT. **Materials and Methods:** This retrospective study analyzed 518 patients with advanced RC. We divided patients in 2 groups: the ones who achieved a complete clinical response after treatment (good responder group) and the ones who did not achieved complete response (poor responder group). All patients underwent pre-treatment and post-treatment FDG PET/CT, with the post-treatment scan performed on average 19 weeks after treatment completion. Among the exclusion criteria were patients who began therapy before pre-treatment PET/CT and patients who did not have both studies, pre and post treatment. We included 37 patients in the good responder group who met all inclusion criteria and were selected for analysis, and 36 patients in the poor responder group. FDG PET/CT was analyzed by two nuclear medicine physician, and qualitative and quantitative analysis were performed. We used a visual response score (VRS) in qualitative analysis: grade 0 – (not reduce/progress) grade 1 (≤ 33% reduction), grade 2 (> 33% to 66% reduction), grade 3 (> 66% reduction), and grade 4 (no uptake after treatment). The following quantitative parameters were analyzed: SUV, MTV, and TLG, with ROIs drawn with a fixed threshold of 41% and a variable threshold which determined the best delimitation of the tumoral area (best fit value). **Results:** In visual analysis of good responders group the majority of patients had a VRS of grade 4 (62%) and grade 3 (33%). For poor responders group, 45.9% patients had a VRS grade 3 , 32.4% grade 2, 16.2%grades 0 and 1 and only 5.4% in grade 4. The average reductions in the analyzed variables were calculated: For good responders there was a reduction of 83% (SUV-mean with 41%); 68% (SUV-mean - BVF); 84% (TLG -41%); 94% (TLG- BVF); 7.29% (MTV-41%); 78% (MTV- BVF). For poor responders had a lower response rate: 51% (SUV-mean with 41%); 41% (SUV-mean - BVF); 63% (TLG -41%); 75% (TLG- BVF); 37 (MTV-41%); 6,5 (MTV- BVF.) **Conclusion:** FDG PET/CT can provide qualitative and quantitative variables in monitoring neoadjuvant radiochemotherapy response and possibly identify patients who will benefit from earlier monitoring and low-risk patients. Further analyses/studies are still needed to establish a cutoff/value for quantitative measures to aid clinicians.

Keywords: 18F-FDG PET/CT, Neoadjuvant response, Rectal cancer.

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THE NECESSITY OF 24-HOUR DELAYED IMAGING IN PATIENTS WITH PYELOCALICEAL DILATION FOR RELATIVE RENAL FUNCTION CALCULATION: A RETROSPECTIVE ANALYSIS

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Introduction/Justification: Static renal scintigraphy using 99mTc-DMSA is an accurate method for diagnosing and monitoring renal scars and allows for semi-quantification of relative tubular function (RTF). However, in cases of hydronephrosis, radiopharmaceutical accumulation in the pyelocaliceal system may interfere with RTF quantification. Although 24-hour images are typically requested to address this issue, they can inconvenience patients and disrupt the nuclear medicine service routine. **Objectives:** This study aimed to assess the impact of additional 24-hour imaging on RTF quantification in patients with hydronephrosis compared to standard 3-hour images. **Materials and Methods:** A retrospective analysis was conducted on patients who underwent renal scintigraphy with 99mTc-DMSA, focusing on those who received additional 24-hour imaging. Patients were divided into two groups: those aged up to 12 years (Group 1) and those over 12 years old (Group 2). Planar images were acquired 3 hours post-injection of 175 mBq of 99mTc-DMSA for adults and 1.5 MBq/kg for patients weighing up to 40 kg. Additional

delayed images were obtained after 24 hours if pyelocaliceal dilation was present. RTF was calculated using both 3-hour and 24-hour images, preferably using semi-automatic regions of interest. The T-Student test was utilized for statistical analysis, considering a difference of ≤ 3% between the two values as not significantly justifying the additional 24-hour image. **Results:** A total of 1,205 consecutive 99mTc-DMSA scans from February 2019 to December 2023 were evaluated. Group 1 comprised 662 patients, with 62 undergoing additional 24-hour imaging, while Group 2 consisted of 543 patients, with 43 undergoing 24-hour imaging. The mean value of the difference between the 3h and 24h images is 1.95% ± 1.83% and median 2 (0 - 6) for Group 1, and 2.40% ± 2.08% and median 2 (0 - 8) for Group 2. Statistical analysis demonstrated equivalence between RTF quantifications obtained at 3-hour and 24-hour imaging for Group 1 $p < 0.0001$, 95% confidence interval (1.45 - 2.42). However, for Group 2, quantifications at 3-hour and 24-hour imaging were not necessarily equivalent $p = 0.0714$, 95% confidence interval (1.76 - 3.05). **Conclusion:** Additional 24-hour imaging with 99mTc-DMSA in patients under 12 years of age with pyelocaliceal dilation does not appear to impact RTF compared to 3-hour images. However, for older patients, 24-hour imaging is necessary for greater accuracy in RTF determination. Further investigations are warranted to better understand factors influencing RTF calculation, guiding the indication for additional 24-hour imaging.

Keywords: DMSA, Hydronephrosis, Nuclear medicine, RTF.

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ACCESSING THE PHARMACOKINETICS OF MAGNETIC NANOPARTICLES IN CIRRHOSIS-ASSOCIATED HEPATOCARCINOGENESIS BY ORDINARY DIFFERENTIAL EQUATION MODELING AND AC BIOSUSCEPTOMETRY

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Introduction/Justification: Magnetic nanoparticles (MNPs) have been explored as a new potential theranostic agent, and several studies have devoted significant efforts to employ MNPs in biomedicine, including their applications as imaging contrast agents in alternating current biosusceptometry (ACB). In this field, the novelty of multichannel alternating current biosusceptometry (MC-ACB) devices allow the generation of real-time magnetic images of processes of biodistribution of MNPs in essays with animal models, including experiments focused on liver diseases. **Objectives:** This study refers to the in vivo biodistribution of MNPs detected by the multichannel ACB system, aimed at how the pharmacokinetics of MNPs is affected in the case of hepatocellular carcinoma. This evaluation has already been presented in a previous paper in terms of experimental results, but not in terms of pharmacokinetic modeling. **Materials and Methods:** In order to quantitatively describe how this disease may alter the biodistribution of MNPs, two different groups of animals are addressed here: a control group of healthy animals (SAL) and a group of animals with hepatocellular carcinoma (DEN/TAA). The MC-ACB system was used to simultaneously record the transit of MNPs in the heart and their accumulation in the liver. Pharmacokinetic rates of change of MNPs are reported here by proceeding with population parameter estimation for two groups of animals: cancer (DEN/TAA) and control (SAL). They refer to the change of MNPs from heart to liver (k1), from liver to heart (k2), and as the irreversible uptake of MNPs by Kupffer cells within a liver subcompartment (k3). All animal experiments were previously approved and performed according to the protocol 7571041120 by the Ethics Committee on Animal Use of the State University of São Paulo (IBB/UNESP). **Results:** Notably, both k2 and k3 were found to differ between groups, but not k1, consistent with the fact that MNP liver pharmacokinetics are expected to be affected by the chemically induced cirrhosis-associated hepatocarcinogenesis of the DEN/TAA group. The fact that k2 and k3 are higher for the DEN/TAA group is related to earlier MNP liver saturation in cirrhosis due to higher blood volume, and cirrhosis-associated hepatocarcinogenesis is revealed to affect the biodistribution of magnetic nanoparticles. **Conclusion:** The modeling approach proposed in the research provides a powerful tool to quantitatively describe the biodistribution of magnetic nanoparticles in healthy and cirrhotic rats, allowing the estimation of pharmacokinetic rate parameters related to the distribution of magnetic nanoparticles. The introduced modeling robustly describes the concentration of nanoparticles in compartments over time, which may assist in the development of targeted drug delivery strategies. Finally, this study highlights the relevance of mathematical modeling for understanding complex phenomena such as nanoparticle interactions with living systems, particularly in the development of effective theranostic applications.

Keywords: Cirrhosis-associated hepatocarcinogenesis, Magnetic nanoparticles, Ordinary differential equations, Parameter estimation, Pharmacokinetic modeling.

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