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OP0189

MACROPHAGE PET/CT IMAGING OF THE FEET CAN CONTRIBUTE TO EARLY PREDICTION OF THERAPY OUTCOME IN RHEUMATOID ARTHRITIS

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Background: Treat-to-target strategies for rheumatoid arthritis (RA) have shown significant improvements in therapy outcomes. Nevertheless, it usually takes a minimum of 12 weeks before clinical assessment of treatment response can be made. Quantitative positron emission tomography (PET) has shown potential to predict clinical response at a very early stage in the treatment in RA patients.⁽¹⁾ In particular, macrophage imaging by [¹¹C]-(R)-PK11195 PET allows for highly sensitive and specific imaging of RA disease activity.^(2,3)

Objectives: To determine whether quantitative assessment using [¹¹C]-(R)-PK11195 PET/CT imaging at 0-2 weeks is associated with subsequent clinical response to therapy with methotrexate and step-down prednisolone (COBRA-light) therapy in therapy-naïve RA patients.

Methods: Whole body [¹¹C]-(R)-PK11195 PET/CT scans were performed at baseline and after two weeks of treatment in thirty-five clinically active and therapy-naïve RA patients and at least two clinically inflamed joints. All patients were DMARD-naïve and received medication according to the COBRA-light schedule. ⁽⁴⁾ Clinical follow up with DAS44 assessment was performed at 0, 2 and 13 weeks of treatment. PET/CT scans were visually assessed by two experienced readers blinded to clinical data and quantitatively analyzed using in-house software. Regions of interest (ROIs) with a fixed size per joint (on both visual PET positive and negative joints) were placed on shoulders, elbows, hips, knees and hand and feet joints, with the CT-scan as anatomical reference. Standardized uptake values (SUVs) normalized for body weight were calculated in these ROIs to determine the amount of tracer uptake per joint. SPSS version 22.0 was used to perform regression analyses. The sum of visually positive joints and the average SUV in hand joints, feet joints and all joints in the body were compared with DAS44 scores.

Results: Included patients were mostly male (51%) and aged 54 ± 12. Baseline DAS44 was 3.2 ± 1.0; all but one of the thirty-five patients demonstrated visually enhanced tracer uptake in one or more joints on PET/CT. A total of 171 (out of 1470) joints (12%) were visually PET positive at baseline. Over 90% of PET positive sites were located either in the wrists (15%), small hand joints (37%), or small feet joints (40%; Figure 1A). After 2 weeks, the number of PET positive joints had decreased to 100, with the highest decrease in quantitative uptake in feet joints (Figure 1B). Notably, both visual and quantitative PET data at baseline and differences between baseline and 2 weeks did not correlate with DAS44 at 13 weeks (DAS44-13wks). However, at 2 weeks, the average SUV in the feet (SUVfeet-2wks) – but not average SUVhands-2wks or average SUVtotalbody-2wks – was significantly correlated with DAS44-13wks ($R^2 = 0.14$, $p = 0.04$). DAS44-2wks and SUVfeet-2wks both contributed independent information to the prediction DAS44-13wks (combined $R^2 = 0.297$, $p < 0.01$).

Figure 1. Changes in [¹¹C]-(R)-PK11195 uptake in MTP joints of a RA patient, before (A) and 2 weeks after initiation of COBRA light treatment (B).

Conclusion: Quantitative macrophage PET assessment in feet joints after 2 weeks of COBRA light treatment in early RA patients correlates with clinical response after 3 months of treatment. This correlation further increases when combined with the DAS44 score at 2 weeks. Therefore, quantitative, non-invasive macrophage PET/CT, especially when combined with early clinical assessment, may be useful for early assessment of response to treatment. Further studies will help optimize timing and focus of the PET examination in prediction of treatment response.

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OP0190

USEFULNESS OF 18F-FLUORODEOXYGLUCOSE POSITRON EMISSION TOMOGRAPHY IN DIAGNOSING POLYMYALGIA RHEUMATICA AND LARGE-VESEL VASCULITIS: A CASE-CONTROL STUDY

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Background: Polymyalgia rheumatica (PMR) is a relatively common disease among the elderly. None of the most common imaging techniques provides diagnostic certainty of PMR. 18F-fluoro-dexoxyglucose positron emission tomography/computed tomography (FDG-PET/CT) may be a useful candidate as it can be used to visualize articular and periarticular FDG uptake at different locations, as well as associated large-vessel vasculitis (LVV), but its usefulness needs to be evaluated in the absence of large-scale case-control studies.

Objectives: The purpose of this study was to determine the usefulness of FDG-PET/CT in diagnosing PMR and LVV.

Methods: We analysed FDG-PET/CT scans performed between January 2015 and December 2019 on patients diagnosed with PMR. For comparisons, patients with PMR were matched 1:1 to controls according to age and sex. FDG-PET/CT scans had been performed on controls over the same period for diagnosis of cancer-associated stroke. FDG uptake was scored visually using a semi-quantitative analysis (score 0-3) for 17 articular or periarticular sites, as described by Sondag et al. [1], and for 13 vascular sites, as described by Slart et al. [2]. The case and control groups were compared using generalized linear mixed models (binomial distribution, logit function) for binary outcomes, and linear mixed models for continuous outcomes, with matched sets as a random effect. The optimal threshold for the number of sites with significant hyperfixation (score ≥ 2) was determined by maximizing the Youden index.

Results: 81 patients with a diagnosis of PMR and 81 controls were included (mean (SD) age 70.7 (9.8) years; 44.4% women). We found significant differences between the PMR and control groups at all articular or periarticular sites for: 1) FDG uptake score ($p < 0.0001$); 2) number of patients per site with significant FDG uptake (score ≥ 2) ($p < 0.0001$); 3) global FDG articular uptake scores (score 0-51) (31 [IQR, 21 to 37] versus 6 [IQR, 3 to 10], $p < 0.001$); and 4) number of sites with significant FDG uptake (score ≥ 2) (score 0-17) (11 [IQR, 7 to 13] versus 1 [IQR, 0 to 2], $p < 0.001$). Using ROC curve analysis (Figure 1), we found that the presence of 6 or more sites with significant FDG uptake (≥ 2) was associated with the diagnosis of PMR with a sensitivity of 84% and a specificity of 96% (AUC 0.96 [95% CI 0.93-0.99]). No significant differences in global FDG vascular uptake scores (score 0-39) or in number of patients with at least 1 significant uptake vascular site (score ≥ 2) were found between the PMR and control groups (1 [IQR, 0 to 4] versus 4 [0 to 6], $p = 0.06$ and 8 (11.3%) versus 10 (14.1%), $p = 0.62$ respectively).