

Methods for Early Diagnosis of Charcot Foot

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Charcot foot is a progressive, destructive disease affecting the bones and joints of the foot. Delays in diagnosis are not uncommon and can lead to advancing deformity and increased risk for amputation..

X-rays have been used since 1966 to classify CN stages but are not sensitive enough to diagnose CN in its early stages. In the proposed Charcot Stage 0, no radiographic changes are observed, but the foot is warm and red. Recognition of Stage 0 may be important for reducing delays in diagnosis and thus reducing risk of progressive deformity and further deleterious effects.

MRI can allow visualization of damage in the soft tissue, joint, and bone marrow, and therefore it is important for early diagnosis. In Stage 0 CN, MRI shows advanced stress injuries and edema in the bone, and also edema of adjacent soft tissue and joint effusion. Recently, 18F-fluoro-deoxy-glucose positron emission tomography (18F-FDG-PET), in which the 18F-FDG tracer accumulates at sites of increased cellular glucose metabolism (e.g., infection and inflammation) has been tested for utility in diagnosis of CN. 18F-FDG-PET scans are highly sensitive but less able to define the anatomic location of increased 18F-FDG accumulation. To address this issue, a hybrid PET/CT technology, which provides precise registration of metabolic and structural imaging data obtained in the same imaging session on a single device, has been developed to improve diagnosis and localization of infection and inflammation. Images from PET/CT scans can be examined visually for focal abnormalities, and data generated from the scan also can be assessed quantitatively by calculating the Maximum Standard Uptake value (SUV max).

A clinical evaluation of the use of PET/CT scans in acute Charcot foot enrolling diabetic patients with clinical suspicion of acute Charcot foot is reported. The protocol involves standard clinical evaluation including temperature recording, MRI and PET/CT scan of the foot at the entry of the protocol, offloading until clinical resolution, and MRI and PET/CT scan at clinical resolution (or lacking that, re-evaluation of the patient prior to the appointment for a final assessment). Results indicate that MRI confirmed CN in 9 of the 10 patients, as did PET/CT scan. Analysis of SUV max values of the patients in this study compared to clinical resolution found a decrease in the mean SUV max value in patients with clinical resolution ($5,11 \pm 2,3$ vs $2,45 \pm 0,9$ $p=0,01$, but no change in patients in which the disease process is still ongoing $SUV \quad 4,33 \pm 0,49$ vs $4,32 \pm 0,33$). This study suggests that PET/CT scanning in conjunction with MRI may be useful for diagnosing acute CN. PET/CT scanning provides visualization of the location of the disease process and its extension at baseline; visual information of the evolution of the original location and new locations in the same or contralateral foot at follow up; and quantification of metabolic activity that can be used as a parameter to evaluate disease progress.