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Original Research Article

Imaging of Charcot Joint in Multiple Sclerosis: A Study of 30 Patients

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Abstract: ***Background***: Charcot joint, known as neuropathic arthropathy, is a disorder often associated with neurodegenerative disorders that lead to decreased pain sensation and proprioception, resulting in joint degeneration. Multiple sclerosis (MS), primarily affecting the central nervous system, which may lead indirectly to the development of neuropathic arthropathy. ***Aim***: was to provide an analysis of the imaging features of Charcot joint in patients with MS, through identifying patterns of joints involvement and bone pathology. ***Methods***: A retrospective study conducted in al-Nasiriyah teaching hospital from 2022-2025 and included thirty MS patients with clinical suspicion of neuropathic arthropathy. Computed tomography (CT), and magnetic resonance imaging (MRI) scans were reviewed to assess the extent of joint pathology and characterize distinct imaging finding. ***Results***: A total of 30 patients where included, their age range of 34–55 years, radiological findings included osteophyte formation in 15 (50%), bone resorption in 9 (30%), and joint subluxation in 6 (20%) of patients, severe joint degeneration in 21 (70%) patients. CT shows joint space narrowing in 18 (60%) patients, verifying the essential need for joints assessment. ***Conclusion***: The study highlights the important role of comprehensive imaging techniques in diagnosing neuropathic arthropathy in MS patients, as both MRI and CT as particularly valuable tools for early detection then planning of the treatment.

Keywords: Charcot Joint, Multiple Sclerosis, Magnetic Resonance Imaging.

INTRODUCTION

Multiple sclerosis (MS) is an autoimmune disease manifest by progressive demyelination of the central nervous system (CNS). As MS advances, its effects on peripheral neural structures can lead to diminished pain perception and proprioception, which, in turn, contribute to musculoskeletal complications [1]. One distinguished complication is Charcot joint, a debilitating condition resulting from repeated microtrauma to joints that lack protective sensation [2].

Charcot joint typically manifests in weight-bearing joints, particularly the knees, hips, and ankles. Its pathology includes severe bone fragmentation, joint space narrowing, and characteristic osteophyte formation. Radiographic evaluation is essential in detecting these signs early to prevent further degradation of the joints [3,4]. The aim of this study was to clarify the imaging features of Charcot joint in patients with MS.

METHODOLOGY

This was a retrospective observational study involved 30 selected patients with confirmed MS and suspected to have Charcot joint based clinically on joint pain, swelling, and/or reduced joint function. The study carried out in in al-Nasiriyah teaching hospital from March 2022 to April 2025. The inclusion criteria are any patient older than 18 years with MS and having joints symptoms to ensure accurate correlation between MS-related neuropathy and joint pathology. Imaging protocols were as following:

- **Radiographic joint x-ray:** Anteroposterior and lateral views of the affected joint to detect if any gross deformities, subluxation, osteophytes, and/or bone destruction.
- **Magnetic resonance imaging (MRI):** MRI sequences as following; T1-weighted image, T2-weighted image, and STIR were used to evaluate soft tissue involvement, including joint effusion, synovial proliferation, and/or ligamentous changes.

- **Computed tomography (CT):** High-resolution CT was used to assess any bony changes concentrating on cortical bone integrity.

All imaging findings were independently reviewed by two radiologists to minimize inter-observer bias.

RESULTS

A total of 30 patients where included, their age range from 34–55 years with mean±SD of 39±14 years, 17 patients were female, while 13 patients were males. The findings were illustrated as following:

Osteophytes were observed in 15 patients (50%), primarily on joint X-ray, with some patients show MRI feature of bone proliferation at the margins of the joint. Bone resorption was detected in 9 patients (30%), it was detected on CT and MRI, highlighting progressive osteolysis in affected articular surfaces. Moreover, joint Subluxation was present in 6 patients (20%) and prominently observed on joint X-Ray. MRI findings were consistent with severe ligamentous disruption in those patients. Regarding joint degeneration, MRI was performed in severe joint degeneration, and joint effusion and synovial hypertrophy were detected in 21 (70%) of the patients, thus indicating active inflammatory response.

Joint space narrowing was detected in CT scans which provided a good specificity for detecting joint space narrowing, it founded in 18 (60%) of cases, highlighting CT scan value in identifying alignment and bony involvement.

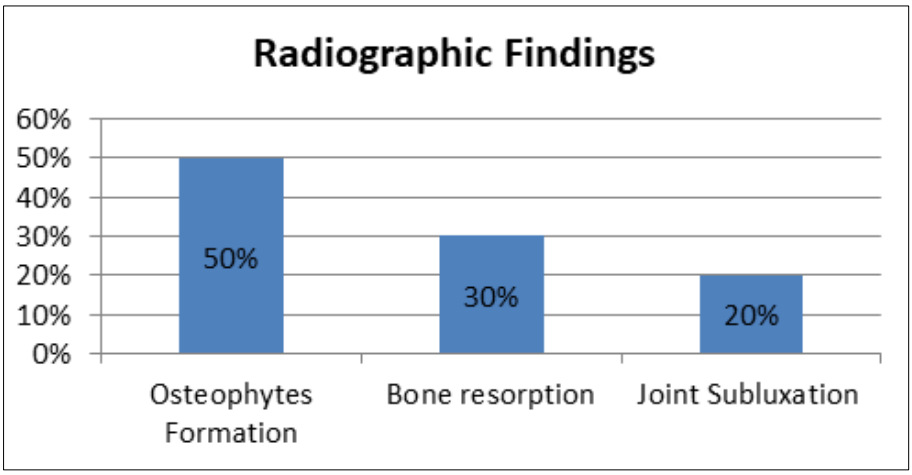

Figure 1: Frequency of radiographic findings in Charcot joint in patients with MS

DISCUSSION

The frequency of Charcot joint in patients with longstanding MS, although it's very uncommon compared to conditions such as diabetes mellitus, it represents a significant challenging for those patients, specifically those with severe neuropathy [5]. Findings from the current study, comprising high frequency of osteophyte formation, bone resorption, joint subluxation, and joint degeneration, are consistent with other literature on neuropathic arthropathy [1-5]. Nevertheless, they highlight the requirement for imaging protocols that suit to the unique challenges that the MS patients face in observing progression of Charcot joint. Pathophysiology: In multiple sclerosis, CNS demyelination lead to disrupted signaling pathways which affect peripheral sensation, result in reduced proprioception and pain reaction [6]. This damage among MS patients can cause sustain repetitive trauma to weight-bearing joints, mainly knees, hips, and ankles joints, which, with inadequate pain sensation, may lead to the development of Charcot joint [7]. Identifying the relation between MS neuropathy and Charcot joint highlights the necessity for practical imaging, particularly in those patients with severe and prolonged MS. Early imaging can detect minor changes thus may prevent progression to severe joint deformities.

Multiple sclerosis consider as a rare etiology of neuropathic arthropathy. The most frequent musculoskeletal criteria of MS patients are weakness of the muscle and contracture of the joints. Joints involvement is rare, Hoang *et al*., study in Australia in2014 reported that out of 156 patients with MS, less than five percentage of those patients have joint involvement [8].

Efficacy of Imaging Modalities in diagnosing Charcot Joint in Patients with MS:

Plain radiographs: In spite of being less sensitive for early soft tissue changes, plain radiography remains extremely helpful in identifying advanced Charcot joint markers like, demineralization, osteophyte formation, joint subluxation, and joint collapse. These radiographic signs are indicative of advanced, often irreversible, joint damage, making radiography a crucial tool in later stage assessments [9, 10]. "Neuropathic joints are often described radiographically as disorganized" [7].

CONCLUSION

Imaging techniques as plain radiograph, MRI, and CT scan provides a complementary perception in detecting and diagnosing Charcot joint in patients with MS. The current study provides a valued perception of the imaging characteristics of Charcot joint in patients with MS.

Recommendations

Patients with prolonged MS should undergo routine radiographic imaging of weight-bearing joints (knees, hips and ankles), even if the clinical symptoms are mild. This routine could include multimodal imaging approach, employing both CT scan and MRI depends on patient's condition for comprehensive evaluation, as MRI is very accurate for detecting soft tissue involvements whereas CT scan affords an accurate assessment of joint alignment and bone pathology.

Competing Interests: None

Authors' Contributions: All had confirms responsibility for the following: study conception and design, data analysis and interpretation of results, and manuscript preparation

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