



## Original Article

# Angiographic assessment of atherosclerotic load at the lower extremity in patients with diabetic foot and charcot neuro-arthropathy

Mehmet B. Çildağ<sup>a,\*</sup>, Bülent M. Ertuğrul<sup>b</sup>, Ömer FK. Köseoğlu<sup>a</sup>, Songül Çildağ<sup>c</sup>,  
David G. Armstrong<sup>d</sup>

<sup>a</sup> Department of Diagnostic and Interventional Radiology, Adnan Menderes University, Aydın, Turkey

<sup>b</sup> Department of Infectious Diseases and Clinical Microbiology, Adnan Menderes University, Aydın, Turkey

<sup>c</sup> Department of Clinical Immunology, Adnan Menderes University, Aydın, Turkey

<sup>d</sup> Department of Surgery, Southern Arizona Limb Salvage Alliance (SALSA), University of Arizona College of Medicine, Tucson, Ariz, USA

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## Abstract

**Background:** The aim of this study was to investigate atherosclerotic load at the lower extremity in patients with diabetic foot and charcot neuro-arthropathy and compare them with patients with diabetic foot without charcot neuro-arthropathy.

**Methods:** This retrospective study consists of 78 patients with diabetic foot who had lower extremity angiography with antegrade approach. All patients were classified into two groups; neuro ischemic wounds with charcot neuro-arthropathy (30/78) and without charcot neuro-arthropathy (48/78). Atherosclerotic load at the side of diabetic foot was determined by using the Bollinger angiogram scoring method. Comparison of atherosclerotic load between the two groups was performed.

**Results:** The mean of total and infrapopliteal level angiogram scoring of all patients was 33.3 (std±17.2) and 29.3 (std±15.6), respectively. The mean of total and infrapopliteal level angiogram scoring of neuroischemic wounds with charcot neuro-arthropathy group was 18.1 (std±11.6) and 15.7 (std±10.4), respectively. The mean of total and infrapopliteal level angiogram scoring of neuroischemic wounds without charcot neuro-arthropathy group was 42.8 (std±12.7) and 37.7 (std±12.0), respectively. There was a statistically significant difference between the two groups of mean total and infrapopliteal angiogram scoring ( $p < 0.01$ ).

**Conclusion:** This angiographic study confirms that the atherosclerotic load in patients with diabetic foot and chronic charcot neuro-arthropathy is significantly less than in patients with neuroischemic diabetic foot wounds without chronic charcot neuro-arthropathy.

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**Keywords:** Angiography; Atherosclerosis; Charcot neuro-arthropathy; Diabetic foot

## 1. Introduction

Foot complications associated with diabetes have a prevalence of 15%–20% in all patients with diabetes and remain

the most common cause of nontraumatic amputations of the lower extremity.<sup>1</sup> Charcot neuro-arthropathy (CN) is a progressive disease affecting the bones, joints and soft tissue of the foot and ankle. Of all patients with diabetes, 0.1–7.5% have CN and 29% of patients with diabetes and peripheral neuropathy have CN.<sup>2,3</sup> CN can lead to severe and debilitating structural deformity of the foot.<sup>4</sup> Atherosclerotic peripheral arterial disease (PAD) is a group of disorders characterized by narrowing or occlusion of the arteries resulting in gradual reduction of blood supply to the limbs. Patients with diabetic foot disease have a greater prevalence of atherosclerotic PAD,

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\* Corresponding author. Dr. Mehmet B Çildağ, Department of Diagnostic and Interventional Radiology, Adnan Menderes University, 0900, Aydın, Turkey.

E-mail address: [mbcildag@yahoo.com](mailto:mbcildag@yahoo.com) (M.B. Çildağ).

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especially infrapopliteal arterial stenosis and occlusions which are more severe in patients with diabetes. Due to the natural course of diabetes mellitus, PAD can be expected in CN cases. Until today, few studies have examined the prevalence of atherosclerotic PAD in patients with diabetes and CN.<sup>5,6</sup> To our knowledge, there have been no studies that have specifically evaluated the pattern and quality of PAD in this population. Additionally, none have focused on the atherosclerotic load in patients with diabetes and CN by using angiography. Bollinger et al. described an angiogram scoring method for assessment of lower limb atherosclerosis, including scoring for plaques, stenoses and occlusions.<sup>7</sup> The Bollinger angiogram scoring method is suitable for differentiating the severity of atherosclerotic PAD, especially in infrapopliteal arteries (see Fig. 2).<sup>8</sup>

The Bypass vs. Angioplasty in Severe Ischemia of the Leg (BASIL) trial used the Bollinger score system to analyze arterial atherosclerotic load in limb ischemia patients. In this trial, mean below-knee Bollinger angiography score that was shown atherosclerotic load, was found as an independent risk factor for both time to death after operation and amputation-free survival.<sup>9,10</sup> Also, technical success rates of infrapopliteal angioplasty were depended to atherosclerotic load in patients with PAD.<sup>11</sup> Although emphasis of atherosclerotic load has been demonstrated in treatment of patients with PAD, the effect of atherosclerotic load in patients with CN is unknown yet.

In this study, we aimed to investigate the atherosclerotic load at the lower extremity using the Bollinger angiogram scoring method in patients with diabetic foot wounds and chronic CN and compare them with patients who had diabetic foot wounds without chronic CN.

## 2. Methods

### 2.1. Study population and design

We abstracted the medical records of people with diabetic foot wounds receiving lower extremity conventional angiography imaging from the Radiology Service database of a single academic medical center. After institutional review board approval, imaging data between October 2014 and March 2016 were evaluated. There were 125 angiography studies with evaluable foot radiographs performed at our institution for evaluation of diabetic foot during the study period. Modified Eichenholtz classification system<sup>12</sup> was used for CN and chronic CN diagnosis was made with clinical such as decreased or absent warmth, edema and erythema and plain radiography such as: remodeled and new bone formation, decreased osteosclerosis and/or possible gross residual deformity.

### 2.2. Patient inclusion criteria

Patients with diabetes and foot ulceration or gangrene who had angiography with antegrade approach and who had plain radiography of the foot and clinical data for CN were included in this study. All patients had undergone magnetic resonance angiography (MRA) before conventional angiography for confirming peripheral arterial disease.

### 2.3. Patient exclusion criteria

Patients with diabetic foot and without any peripheral arterial disease suspicion at MRA, patients whose data



Fig. 1. Sixty year old male who had diabetic foot and charcot neuro arthropathy at talonavicular, calcaneo-cuboid joints. Also lateral radiography shows subluxation of cuboid.

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