

Anchoring Bias in the Case of Charcot's Foot

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## **Abstract**

During my six-week Home for the Summer exposure at Portage La Prairie, I met several patients with diagnosed late stage Charcot's Arthropathy. What each of these individuals had in common was that they were all misdiagnosed initially. Charcot's Arthropathy is a chronic, destructive, and non-infectious process that commonly affects people with neuropathy, such as those with diabetic neuropathy.<sup>4</sup> This condition initially presents as a single red, hot, swollen foot which may or not be painful. It is commonly misdiagnosed as an infectious process and the patient is prescribed antibiotics, usually several courses of antibiotics, despite lack of resolution of symptoms. Each misdiagnosed case illustrates anchoring bias, where clinicians lock on to a diagnosis and fail to adjust the diagnosis despite contradicting or nonsporting information.<sup>2</sup> To many physicians, a red hot swollen foot equals an infection, but this is not the mechanism underlying Charcot's Arthropathy. Due to improper management, the disease progresses to foot deformity and the patient's quality of life is severely affected by future risks of ulcers, infections and even amputations.

The focus of this paper is to highlight the importance of having a high level of suspicion of Charcot's Arthropathy, especially in particular patient populations such as those with known diabetes. In addition, risk factors and proper management guidelines will be discussed to assist in early diagnosis with the intention to prevent the morbidities associated with this condition.

## **Introduction**

Portage La Prairie is a small city in Manitoba, with a population of 12,949 in 2016.<sup>6</sup> The median age of Portage la Prairie residents is 40.8, comparable to national median age of 40.1 years of age.<sup>6</sup> The median (after-tax) household income in the area is \$46, 963 which is lower than the national rate of \$54,089.<sup>6</sup> Approximately 75% of the population is white and the

remaining population is predominantly Aboriginal, mainly First Nations and Metis.<sup>6</sup> This demographic information is important for clinicians to consider as it should play an important role in deciding the best treatment options for each individual patient.

Charcot Arthropathy, also known as Neuroosteoarthropathy and Charcot's Foot, is a chronic, progressive, destructive, and non-infectious process that most frequently affects the bone architecture of the affected foot in patients with sensory neuropathy.<sup>4</sup> Charcot Foot is classified based on whether there is an active inflammatory process present (known as acute Charcot's Foot), whether there is unilateral or bilateral presentation, the location in the affected foot (hind foot, midfoot, or forefoot) and the stage of the disease. The progression of this condition follows from stage 0 to stage 3.<sup>7</sup> At stage 0 radiographic changes are absent and stages progress to stage 3 where this is obvious foot deformity. Although Charcot's Arthropathy is a non-communicable process, the inflammatory process occurring makes the limb especially susceptible to deformity.<sup>5</sup> The loss of pain sensation and proprioception combined with repetitive mechanical trauma to the foot leads to repetitive bone remodeling.<sup>5</sup> Over time, Charcot Arthropathy may lead to a loss of osteoligamentous foot architecture resulting in loss of foot stability.<sup>4</sup> When improperly managed, advanced Charcot's Foot is susceptible to subsequent soft-tissue complications such as skin breakdown, recurrent ulcerations, and infections.<sup>4</sup> The classic deformity associated with Charcot foot is "rocker bottom deformity" which is a collapse of midfoot, associated with stage 3 Charcot's Foot.<sup>7</sup>

Currently, general evidence-based treatment algorithms are lacking and the literature is inconsistent regarding both the ideal treatment type and timing of treatment. Most literature suggest non-weight bearing management during the first months to stop progression of deformity. The use of a full contact cast in addition to a non-weight bearing period of 8–12 weeks is ideally

recommended to avoid trauma to the affected foot. Once the patient's foot architecture is collapsed the only effective way to restore the damage is through surgical measures. For surgery to be effective both neurovascular structures need to be intact to prevent malunion and infection. Due to active neuropathy, patients are considered high risk surgical candidates which is currently the argument against selecting internal fixation in advanced stage Charcot's Arthropathy patients. Nevertheless, there are situations where stability of the foot can only be achieved through operative intervention and in select patient populations this may be a reasonable therapeutic option.<sup>5</sup> The fact is that the longer the patient waits to have surgery, the more progressed the Charcot's Foot will be and therefore the higher the operative risks.

As the prevalence of diabetes increases in our society, diagnosis and treatment of Charcot's Arthropathy is going to become increasingly more important.<sup>5</sup> Health providers need to advocate for better patient outcomes by providing better prevention programs to reduce the economic burden for both the patient and the health care system.<sup>1</sup>

### **Methods and materials**

A total of six patients with known Charcot's Osteoarthropathy were first identified by physicians at the Portage La Prairie hospital. All patients were known to have late stage Charcot's Arthropathy. A retrospective analysis of all medical records of patients was done to verify Charcot's Foot diagnosis and to retrace management of the individual's course of illness. Identified patients were asked about the course and initial management leading up to their current clinical presentation. Inclusion criteria were: diagnosis of Charcot's Foot according to the definition and diagnostic criteria as defined by Diabetic Foot Clinic in Winnipeg. Only patients actively seeking medical treatment from July-August 2018 at the Portage Hospital were interviewed. This included four patients who are all receiving dialysis on a weekly basis at the

hospital. Exclusion criteria were: patients who not actively seeking medical treatment at the Portage Hospital during the above time periods and those who did not consent to being interviewed.

### **Data collection**

This retrospective analysis includes a total of four diabetes positive individuals, all male, actively receiving dialysis at the Portage La Prairie Hospital, over period of six weeks from July-August 2018. Nurses on the dialysis unit provided each patient's dialysis schedule and access to each patient's paper medical chart. Diagnosis of Charcot's foot was confirmed by review of medical record and previous laboratory and radiographic tests. Verbal informed consent was taken from all participating individuals after explaining the purpose of the study to the patients interviewed. Patients were asked a series of standardized questions about their current state of health, their past medical history, their current social history and information regarding their understanding of the progression of their Charcot's Foot such as initial clinical presentation and course of treatment by doctors at the Portage La Prairie hospital and other medical staff in Winnipeg.

At the time of the interview a quick physical exam was conducted focusing on the affected extremity. This exam included observation of the patient's feet (for colour, capillary refill time, and deformity), palpation for peripheral pulses and examination of intact sensation with light touch. All patients at some point had been in contact with the wound care clinic nurse at the Portage La Prairie Clinic and had been sent to the Diabetic Foot Clinic in Winnipeg. Information presented in this paper regarding management of Charcot's Foot was gathered from in person conversations with the Wound Care Clinic nurse and interactions with both doctors and patients at Portage La Prairie Hospital.

## Results

All patients affected had a prior diagnosis of diabetes, confirmed by laboratory results in their medical charts. Patients displayed a wide range of both macrovascular and microvascular complications due to their diabetes ranging from peripheral neuropathy, retinopathy, to nephropathy. Patients were all male, actively receiving dialysis at the Portage La Prairie hospital, over period of six weeks from July-August 2018. Patients confirmed that the initial presentation of their illness was a single red, hot, swollen foot with no known trauma preceding the event. Patients who remembered this stage of the disease admit that they were not primarily concerned with the appearance of their foot because they did not feel pain. Instead, patients had come to hospital for different reasons, such as receiving dialysis, and then mentioned concerns about their affected limb to the medical staff. At some point, all patients were taken to emergency for further workup of their red, hot, and swollen extremity. All patients were X-rayed at emergency, radiographic findings were shown to be unremarkable initially and patient was discharged with oral antibiotics. Anecdotally patients admitted that they were trialed multiple courses of antibiotics but did not see resolution of symptoms. Over the next several months to years all patients saw a gradual collapse of their foot architecture which limited their ability to be independently mobile. Patients complained about not being able to find shoes that fit as the shape of each of their feet was significantly different. For most patients, a definitive diagnosis of Charcot's Foot was not made until referral to the Diabetic Foot Clinic by the Portage La Prairie staff. Despite custom made orthotics, all patients had documented reoccurring ulcers of the same affected foot in their medical charts.

At the time of the study all patients had late stage Charcot's foot with a classic rocker bottom deformity. Some patients had grayish white skin to their feet, active ulcers and toe

amputations. All patients wore special orthotics and received active foot care assessment weekly. Peripheral pulses were either faint or absent in many patients. Capillary refill time was noted to be reduced in all patients. Active peripheral neuropathy was demonstrated with diminished sensation of light touch on the dorsal aspect of both the Charcot's affected and non-affected foot.

## **Discussion**

It is uncertain what the incidence or prevalence of Charcot's Foot is in general population and within the diabetic population. The actual prevalence may be higher due to delay in diagnosis or misdiagnosis.<sup>7</sup> Emergency doctors at Portage La Prairie admit that they would miss Charcot's Foot diagnosis one hundred percent of the time because they would treat the patient with suspicion of infection. This case highlights cognitive errors for which physicians are at risk when making clinical decisions. A high suspicion for Charcot's Foot must be present in patients with known diabetic neuropathy, peripheral arterial disease, minor trauma preceding red foot and where the entire foot is erythematous with absence of skin breakdown, tophi or effusions.<sup>4</sup>

Current literature supports significant association ( $p < 0.05$ ) of deformity with duration of diabetes, HbA1C levels and presence of neuropathy.<sup>7</sup> A significant risk factor identified of all gangrene and amputation cases was duration of diabetes. A positive 10-year diabetes diagnosis was associated with higher incidence of foot ulcers, gangrene cases, and amputation rates.<sup>1</sup> In contrast, no significant association ( $p > 0.05$ ) was found with age, BMI, weight, height and gender.<sup>7</sup> Despite the lack of association between deformity and sex, all six patients originally identified were male. Perhaps the stereotype that males seek medical treatment only at late stages may be a contributing factor for why patients were predominately male.

Once the diagnosis is made, management must be immediate. Two courses of management include surgical and non-surgical. Patients may be limited to conservative

therapeutic options due to presence of comorbidities which classify them as high risk surgical candidates.<sup>5</sup> Non-surgical interventions include protected non-weight bearing treatment achieved by total contact cast or custom-made orthosis. This is a relatively inexpensive mode of treatment and it is readily available in small rural centers. Cast changes are recommended to be made at least every second week by a professionally trained technician.<sup>3</sup> Removable, non-custom made devices are not recommended as they are associated with diminished compliance due to the easy removability of the device by the patient.

### **Limitations**

The limitations of this study are numerous. The biggest limitation of studying Charcot's Foot is largely due to lack of awareness of this condition and lack of sample size. Given that the initial presentation of this disease is misdiagnosed it was difficult to construct incidence and prevalence data. Patients presenting to the emergency with red, hot swollen extremity were categorized into 3 categories based on the discretion of the admitting nurse. These categories included cellulitis, skin, and lower extremity pain. In other words, there is no consistent method of documenting Charcot's Foot. Data collection may not have been reliable as all patients in this study had last stage Charcot's Foot and had difficulties recalling the initial disease presentation several years earlier. In addition, paper charts were not inclusive, for example information from emergency room visits and consultations to the Diabetic Foot Clinic in Winnipeg were absent in the paper charts. Furthermore, this is a relatively rare condition and literature is still lacking supporting evidence based treatment type and timing.

### **Conclusion**

Charcot Foot is a chronic, non-communicable condition of bones and joints which may result into severe deformity making the limb susceptible to developing ulcers, increases risk of



infections and amputation, sometimes even causing death.<sup>7</sup> At the first onset of red, hot, swollen foot, patients should be treated conservatively with non-weight bearing total contact cast for a minimum period of 8-12 weeks to allow the limb to “cool down” from the acute inflammatory state. Surgical interventions are the only treatment option available to late stage Charcot’s Foot but many patients may not qualify for this treatment due to comorbidities and being high risk surgical candidates. Increasing awareness about this condition and increasing patient education can lead to early diagnosis, and timely appropriate treatment which can help in avoiding severe, irreversible disability and deformity. This can further reduce the economic burden of the complications on both the patient and healthcare system.

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