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Assessing Interaction between Charcot-Marie-Tooth Disease, Ankle Injury, and Type 2 Diabetes Mellitus

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Abstract:

Both diabetes mellitus and Charcot-Marie-Tooth disease (CMT) can cause severe peripheral neuropathy. Diagnosing peripheral neuropathy might be challenging due to its comparable clinical characteristics. Unusual muscular atrophy and severe peripheral neurogenic damage with nephropathy or retinopathy might help physicians develop a differential diagnosis. Diabetes mellitus can worsen clinical abnormalities in persons with CMT, despite the fact that it seldom occurs concurrently. Currently, there is no particular medication for CMT therapy. Using offloading devices and managing diabetes can help prevent plantar ulcers and slow the progression of CMT.

Keywords: Charcot-Marie-Tooth disease, Type II DM, Leg rash, Metformin

Introduction:

Foot ulcers are a serious consequence of diabetes mellitus, leading to greater amputation rates and fatality rates. The most prevalent risk factor of foot ulcers is known as diabetic peripheral neuropathy (DPN), which might lead to loss of protective feeling and worsened mechanical foot pressure. Diabetic peripheral neuropathy (DPN) is easily diagnosed based on diabetes duration, poor glucose control, clinical characteristics, and auxiliary examinations (e.g., electromyogram). Diabetic peripheral neuropathy (DPN3) should not be confused with other peripheral nerve illnesses that might worsen lower limb deficits.[1-2]

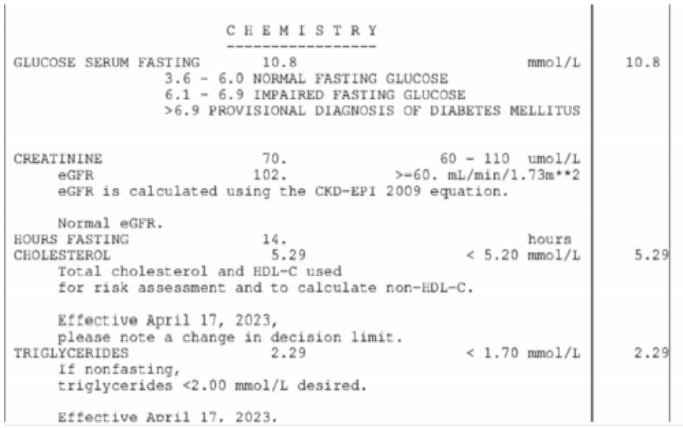
Charcot-Marie-Tooth disease (CMT) is the most prevalent hereditary polyneuropathy, with a global frequency of 1/2,500(4). CMT is characterized by sensory loss, symmetrical distal muscle weakness, and reduced deep tendon reflexes. Patients with CMT may only have distal symmetrical sensory loss, making the differential diagnosis challenging due to similarities with DPN.[3]

Case Report:

A 54 years old male patient diagnosed with type II Diabetes mellitus and Charcot-Marie-Tooth Disease (CMT) was presented in emergency department, history of left ankle fracture on March 25th, 2024 treated surgically on March 27th, 2024. While right ankle closed repair was reported in 2019. The presenting complaint was left leg rash, ankle swelling and pain. The patient reported gradual increase in swelling post-injury, worsen with orthotic use and recent decrease in physical activity. Possible justification of rash was contact dermatitis from new compression stockings. HbA1c levels were reportedly reduced (9.7%-7.2%) within few months. Liver function was reportedly elevated indicating fatty liver with HDL on 0.88.

The patient is prescribed on Metformin HCL 500 mg 2x a day, furosmide 40mg once a day and clotrimazole/betamethasone dipropionate 1%- 0.05% topical cream.

This case highlights the difficulty experienced by people with Charcot-Marie-Tooth disease, including treating an ankle injury and edema, and its consequences for diabetes control. Close monitoring and coordinated care are crucial for improving outcomes in this patient population.



CHEMISTRY

GLUCOSE SERUM FASTING	10.8		mmol/L	10.8
	3.6 - 6.0 NORMAL FASTING GLUCOSE			
	6.1 - 6.9 IMPAIRED FASTING GLUCOSE			
	>6.9 PROVISIONAL DIAGNOSIS OF DIABETES MELLITUS			
CREATININE	70.	60 - 110	umol/L	
eGFR	102.	>=60.	mL/min/1.73m**2	
eGFR is calculated using the CKD-EPI 2009 equation.				
Normal eGFR.				
HOURS FASTING	14.		hours	
CHOLESTEROL	5.29	< 5.20	mmol/L	5.29
Total cholesterol and HDL-C used for risk assessment and to calculate non-HDL-C.				
Effective April 17, 2023, please note a change in decision limit.				
TRIGLYCERIDES	2.29	< 1.70	mmol/L	2.29
If nonfasting, triglycerides <2.00 mmol/L desired.				
Effective April 17, 2023.				

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TRIGLYCERIDES	2.29	< 1.70 mmol/L	2.29
If nonfasting, triglycerides <2.00 mmol/L desired.			
Effective April 17, 2023, please note a change in decision limit.			
HDL CHOLESTEROL	0.90	mmol/L	0.90
		M: >=1.00 mmol/L	
HDL-C <1.00 mmol/L indicates risk for metabolic syndrome.			
Effective April 17, 2023, please note a change in decision limit.			
LDL CHOLESTEROL CALC.	3.45	< 3.50 mmol/L	
LDL-C was calculated using the NIH equation.			
For additional LDL-C and non-HDL-C thresholds based on risk stratification, refer to 2021 CCS Guidelines.			
Effective April 17, 2023, please note a change in decision limit.			
Triglycerides exceed 1.50 mmol/L. For dyslipidemia assessment, refer to apoB or non-HDL-C			
NON-HDL-CHOLESTEROL(CALC	4.39	< 4.20 mmol/L	4.39
Effective April 17, 2023, please note a change in decision limit.			
If non-HDL-C >= 4.20 mmol/L in primary prevention setting for low risk patients (FRS 5.0-9.9%) or intermediate risk patients (FRS 10.0-19.9%), consider therapy. Therapy also suggested in low risk patients (FRS <10.0%) with non-HDL-C >= 5.8 mmol/L.			
**********			
HEMOGLOBIN A1c	9.0	%	9.0
	NON-DIABETIC:	< 6.0 %	
	PREDIABETES:	6.0 - 6.4 %	
	DIABETIC:	> 6.4 %	
	OPTIMAL CONTROL:	< 7.0 %	
	SUB-OPTIMAL CONTROL:	7.0 - 8.4 %	
	INADEQUATE CONTROL:	> 8.4 %	

Discussion:

Charcot-Marie-Tooth (CMT) disease, commonly known as peroneal muscular atrophy, is a hereditary neuropathy marked by the degeneration or aberrant development of peripheral nerves. In most cases, it appears in childhood and is defined by a clumsy stride caused by distal muscular atrophy in the limbs, as well as a foot drop-shaped deformity. Currently, there are varieties of this illness that appear according to the inheritance mechanism as autosomal dominant or recessive, or connected to the X chromosome; in its electrophysiological manifestations (demyelinating or axonal), depending on the underlying mutation gene.The most prevalent hereditary neuropathy is CMT illness, which affects both the motor and sensory nerves. It affects around one in every 2,500 persons in the United States. These weaken the foot and lower leg muscles. Foot abnormalities, which make walking difficult and frequently cause falls, are also prevalent.[4-5]

Diabetic foot lesions can be neuropathic (55%), is-chemic (10%), or neuroischemic (35%), depending on the underlying cause. The majority of DM2 problems are caused by the patient's inadequate control and treatment of the condition. Charcot arthropathy is one of the most serious foot issues that can lead to these consequences, and in severe instances, limb amputation is required.[6]

Diabetic foot ulcers are a frequent complication that can be caused by two or more risk factors, including diabetic peripheral neuropathy and peripheral vascular disease. As neuropathy continues, it produces numbness and, in certain cases, deformities of the foot, frequently resulting in abnormal weight distribution on the foot. People who suffer from neuropathy and experience trauma due to poor footwear or external injuries are more likely to develop foot ulcers.Loss of protective feeling, foot abnormalities, and reduced joint mobility can all result in improper biomechanical strain on the foot.[7]

Charcot neuroarthropathy, often known as Charcot disease (CAP), is an uncommon but devastating and debilitating consequence of diabetes that can lead to amputations and increased mortality as it progresses. This entity is defined by a destructive inflammatory process of the foot and ankle that progresses over time and is non-infectious. It causes bone, joint, and ligament damage, which compromises the structure and function of the foot, resulting in microfractures, fractures, and dislocations of the foot bones, and, in severe cases, amputation.[8-9]

A patient with Charcot arthropathy caused by diabetes mellitus may be mainly pain-free yet have other symptoms. The most obvious symptom of an early Charcot foot is swelling of the foot. This can happen without any prior injury; foot redness, swelling, and changes in bone structure can all occur in the early stages; if not treated properly, it can progress to a fracture or amputation of the limb.[10-11]

Diabetes seldom coexists with CMT1A but might worsen its symptoms. The mechanism of this relationship is currently unknown. Diabetes does not worsen the neuropathy caused by CMT1A directly. Previous animal studies suggest that hyperglycemia might cause transmission anomalies at the neuromuscular junction, potentially aggravating CMT1A. Diabetes mellitus may worsen pre-existing demyelinating Schwann cells and axonal structural abnormalities, leading to axon regeneration disorders. Currently, there is no particular treatment for CMT in clinics10. Offloading devices and complete diabetes control may help prevent plantar ulcer recurrence and slow the course of CMT.[12]

Conclusion:

CMT shows considerable variations in presentation, making positive association between Charcot-Marie-Tooth (CMT) disease, Ankle Injury, and Type 2 Diabetes Mellitus has increased the chances of accurate diagnosis and reduced the risk of further complications for this patients.

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