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Diffusion tensor imaging proves promising in detecting and describing peripheral nerve changes in type 2 diabetes

Aim: To investigate the diagnostic accuracy of diffusion tensor imaging (DTI) in detecting diabetic peripheral neuropathy (DPN) in participants with type 2 diabetes (DM2).
Methods: 27 participants with DM2 and with DPN (DPN), 24 participants with DM2 without DPN (NDPN), and 32 healthy controls (HC) were examined with DTI of peripheral nerves. Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) were calculated for the tibial (TN) and common peroneal nerve (CPN) (higher values of FA reflect more unidirectional water-diffusion, whereas higher values of ADC reflect more unrestricted water diffusion in all directions). Nerve conduction studies of TN and CPN were applied for assessment of DPN, and motor nerve conduction velocity (MCV) and motor amplitude (MA) were used to characterize nerve impairments as demyelinating or axonal injuries, respectively. ROC analysis was used to assess the diagnostic ability of DTI in detecting DPN.
Results: Higher diffusion with less unidirectional restriction was observed in participants with DPN demonstrating higher values of ADC and lower FAs compared to NDPN and HC in both the TN and CPN. Axonal injury was related to a larger change in diffusion parameters (higher ADC and lower FA's) as compared to demyelination injuries. DTI parameters showed high sensitivity and specificity in ROC analysis with FA's performing best in detecting DPN of peripheral nerves.
Conclusions: Diffusion tensor imaging of peripheral nerves proves promising in detecting DPN in type 2 diabetes and may further distinguish between morphological characteristics of demyelinating and axonal nerve injuries.

Comments. For sensory nerves morphological evaluation is relatively easily accessible by skin biopsies. Clearly, such a measure is not accessible for motor nerves. The potential of MRI on peripheral nerves for detecting and describing DPN in individuals with type 1 and 2 diabetes, in a non-invasive manner, have been demonstrated in a few recent studies. Only a single previous study has reported on the application of DTI on peripheral nerves in DM2 (Vaeggemose M et al *J Diabetes Complications. 2020;34:107439*). In agreement with Vaeggemose et al, the present study demonstrates high accuracy of DTI, especially FA, in detecting DPN. An AUC of FA (FA-AUC) of 0.93 of the TN was reported in both studies. Additionally, FA-AUC was reported as 0.98 for the sciatic nerve at midthigh in Vaeggemose et al., and as 0.90 for the CPN at the distal thigh in the present study. These findings suggest a high diagnostic accuracy of DTI in detecting DPN on several regions of the TN, whereas evaluation of the sciatic nerve seems superior prior to branching as compared to evaluation of the CPN. Moreover, since progressive axonal degeneration is considered the predominant nerve pathophysiology of DPN, future studies should aim to validate the present finding of diffusion parameters being more sensitive to axonal nerve injuries. If validated, DTI could prove useful in distinguishing DPN from neuropathies characterized by more demyelinating features. Still, suspected underlying morphological changes to DTI remains speculative, and studies examining a direct correlation to histological findings are lacking.

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Reference. Wang X, Luo L, Xing J, Wang J, Shi B, Li YM, Li YG. Assessment of peripheral neuropathy in type 2 diabetes by diffusion tensor imaging. Quant Imaging Med Surg. 2022 Jan;12(1):395-405. doi: 10.21037/qims-21-126.
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