Title:

Early Detection of Neuropathy in Children with Type 1 Diabetes and the Influence of Biological Variables

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Background/Introduction:

A reduced nerve conduction velocity (NCV) has been detected in children with type 1 diabetes (T1D) as an early subclinical manifestation of diabetic peripheral neuropathy (DPN). While NCV is only sensitive to changes in the large myelinated fibres, at the initial stage of DPN, small, unmyelinated nerve fibres are damaged. These can be represented by the cross-sectional area (CSA) of peripheral nerves, measured by high-resolution ultrasound. This study aims to establish normative data in healthy children and to identify DPN and the contributing factors at a subclinical disease stage.

Methods:

In 40 patients with T1D (12-15 years) and 34 controls, the CSA of the median nerve was measured sonographically proximal to the flexor retinaculum (R1) and in the middle of the forearm (R2). Significant ($p<0.05$) group differences were assessed with the Mann–Whitney test and the correlation of CSA at R2 with body surface area (BSA), BMI or HbA1c with Pearsons coefficient.

Results:

CSA was significantly larger in the diabetes than in the control group ($p <0.01$), whereas this was no longer significant in subgroups of lean children, i.e. with a BMI below the 60th percentile. In both the control and T1D groups, CSA was associated with BSA ($r = 0.56$, $p < 0.01$ and $r = 0.64$, $p <0.0001$, respectively) or BMI, but the latter was significant only in children with T1D ($r = 0.43$, $p < 0.01$). HbA1c level correlated with nerve thickness adjusted for BSA (CSA/BSA) ($r=0.47$, $p < 0.01$). In a subgroup of children with onset of T1D before the age of 8 years, CSA/BSA was elevated compared to controls ($p < 0.01$) despite satisfactory glycaemic control (HbA1c <8%) and did not correlate with HbA1c.

Conclusion:

In children with T1D, median nerve thickness is increased; its CSA is related to body surface, adiposity and HbA1c level. Young age at diabetes onset appears to contribute to DPN. The present data suggest that early small fibre neuropathy, as represented by thickened CSA/BSA, can be mitigated by a normal BMI and good glycaemic control. Future studies will assess the potential of digital biomarkers from CGM and physical activity wearables to predict the development of early stages of neuropathy.

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Self declaration of category:	☐ basic-experimental	☒ clinical
Asemo:	☐ yes	☒ no
Status of first author:	☐ student	☒ no student