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Sudoscan: An alternative tool for the screening and follow-up of the microvascular complications of diabetes

Peter Schwarz University of Dresden, Germany

Background: Microvascular complications (MVC) of diabetes mellitus (DM), including peripheral neuropathy (DPN), nephropathy (DKD) and retinopathy lead to significant morbidity; yet few non-invasive, practical, and reliable tools are available for early detection, prevention, or follow-up. Sweat function measurement has been suggested for early assessment of small fiber neuropathy. SUDOSCAN is a quick, non invasive and quantitative method to measure sweat function based on an electrochemical reaction between sweat chlorides and large electrodes in contact with the palms of the hands and soles of the feet. Results are reported as electrochemical skin conductances (ESC) and reflect the function of small and autonomic peripheral nerves. We report the findings of 3 studies using SUDOSCAN* and how these may impact the management of DM by clinicians.

Methods: 3 investigators at 3 American academic centers completed SUDOSCAN tests on healthy controls (HC), patients with type 1 (T1D) or 2 DM (T2D), or patients with suspected neuropathy (SN). Results were adjusted for covariates in each study individually.

Results: Among 83 T1D and T2D patients and 210 HC, foot ESC scores had a sensitivity of 78% and a specificity of 92% to detect DPN defined by the Toronto convention. DM patients with DPN had significantly worse ESC of both feet and hands than patients without DPN (56.3±3 vs. 75.9±5.5, p<0.005 for feet, and 51.9±2.4 vs. 67.5±4.3, p<0.005 for hands). DM patients with painful DPN had significantly worse feet ESC than patients with non-painful DPN (52.8±3.6 vs. 68±6.6, p<0.05). Among 37 patients with SN, 15 with DM, neuropathy was confirmed in 30 using Utah Early Neuropathy Score, while SUDOSCAN had a diagnostic performance similar to intraepidermal nerve fiber density and quantitative sudomotor axon reflex testing (area under the curve 0.73, 0.80, and 0.77 respectively). Feet and hand ESC in patients with SN correlated with symptoms on the Michigan Neuropathy Screening Instrument (-0.420, 0<0.015 and -0.469, p<0.006 respectively). In African American (AA) T2D patients with minimal DKD, there was a positive association between ESC and estimated glomerular filtration rate (eGFR) (parameter estimate 3.38, standard error 1.2; p=5.2E-3). These results are being investigated further in Caucasian and AA DM patients with eGFR<60ml/min/1.73 m2. AA, both healthy and T2D, have lower hands and feet ESC than Caucasians (p<0.0001). Further studies are needed to assess SUDOSCAN's ability to measure a patient's response to intervention for DPN and to detect MVC in pre-diabetic conditions.

Biography

Peter Schwarz studied medicine at "Medizinische Fakultät Carl Gustav Carus" in Dresden and completed his dissertation in 2001. From 1999 – 2000, he worked as Postdoc at University of Chicago in a Howard Hughes Institute. 2000 – 2007, he worked as resident for the Department of Endocrinology and Metabolic diseases at "Technische Universität". In 2007, he obtained his qualification as a specialist for Internal Medicine. Since 2008, Prof. Schwarz is head of the Division of Prevention and Care of Diabetes at "Universitätsklinikum Carl Gustav Carus" in Dresden. In 2008, he obtained his postdoctoral lecture qualification and was appointed as Professor of Prevention and Care of Diabetes. The aims of his work are the development and monitoring of the implementation of programs for primary prevention of type 2 diabetes and its implementation in in-patient and out-patient care as part of innovative Chronic Care Management. He is coordinating a number of large European Research Projects and is member of the scientific advisory board of the "Diabetes-Präventions-Forum (DPF)" of the International Diabetes Association in the European Union (IDF-EUROPE). He has published a large number of national and international publications.

Peter.Schwarz@uniklinikum-dresden.de