Journal of Diabetes Science and Technology
Volume 6, Issue 2, March 2012

ORIGINAL ARTICLE

Plantar Fascia Thickness is Longitudinally Associated with Retinopathy and Renal Dysfunction: A Prospective Study from Adolescence to Adulthood

Paul Z. Benitez-Aguirre, M.P.H., FRACP,[1,2] Maria E. Craig, Ph.D., FRACP,[1,2,3] Alicia J. Jenkins, M.D., FRACP, FRCP,[4] Patricia H. Gallego M.D., FRACP,[5] Janine Cusumano, R.N.,[1] Anthony C. Duffin, Ph.D.,[1,6] Stephen Hing, FRCS, FRANZCO,[1] and Kim C. Donaghue, Ph.D., FRACP[1,2]

Abstract

Aim:

The aim was to study the longitudinal relationship between plantar fascia thickness (PFT) as a measure of tissue glycation and microvascular (MV) complications in young persons with type 1 diabetes (T1DM).

Methods:

We conducted a prospective longitudinal cohort study of 152 (69 male) adolescents with T1DM who underwent repeated MV complications assessments and ultrasound measurements of PFT from baseline (1997–2002) until 2008. Retinopathy was assessed by 7-field stereoscopic fundal photography and nephropathy by albumin excretion rate (AER) from three timed overnight urine specimens. Longitudinal analysis was performed using generalized estimating equations (GEE).

Results:

Median (interquartile range) age at baseline was 15.1 (13.4–16.8) years, and median follow-up was 8.3 (7.0–9.5) years, with 4 (3–6) visits per patient. Glycemic control improved from baseline to final visit [glycated hemoglobin (HbA1c) 8.5% to 8.0%, respectively; $p = .004$]. Prevalence of retinopathy increased from 20% to 51% ($p < .001$) and early elevation of AER (>7.5 μg/min) increased from 26% to 29% ($p = .2$). A greater increase in PFT (mm/year) was associated with retinopathy at the final assessment (ΔPFT 1st vs. 2nd–4th quartiles, $\chi^2 = 9.87$, $p = .02$). In multivariate GEE, greater PFT was longitudinally associated with retinopathy [odds ratio (OR) 4.6, 95% confidence interval (CI) 2.0–10.3] and early renal dysfunction (OR 3.2, CI 1.3–8.0) after adjusting for gender, blood pressure standard deviation scores, HbA1c, and total cholesterol.

continued →

Author Affiliations: [1]Institute of Endocrinology and Diabetes, The Children's Hospital at Westmead, Sydney, New South Wales, Australia; [2]Discipline of Paediatrics and Child Health, University of Sydney, Sydney, New South Wales, Australia; [3]The University of Melbourne, Department of Medicine, St Vincent's Hospital, Melbourne, Victoria, Australia; [4]London Health Sciences Centre, Children's Hospital, The University of Western Ontario, London, Ontario, Canada; and [5]University of Western Sydney, Sydney, New South Wales, Australia

Abbreviations: (AER) albumin excretion rate, (AGE) advanced glycation end product, (BMI) body mass index, (DBP) diastolic blood pressure, (DCCT) Diabetes Control and Complications Trial, (GEE) generalized estimating equations, (HbA1c) glycated hemoglobin, (MA) microalbuminuria, (MV) microvascular, (OR) odds ratio, (ORPS) Oxford Regional Prospective Study, (PFT) plantar fascia thickness, (RAGE) advanced glycation end product receptors, (SBP) systolic blood pressure, (SD) standard deviation, (SDS) standard deviation scores, (T1DM) type 1 diabetes mellitus

Keywords: advanced glycation end products, diabetes complications, metabolic memory, nephropathy, retinopathy, tissue glycation

Corresponding Author: Kim Donaghue, Ph.D., FRACP, Institute of Endocrinology and Diabetes, The Children's Hospital at Westmead, Locked Bag 4001, Westmead 2145, New South Wales, Australia; email address kimd@chw.edu.au

Abstract cont.

Conclusions:

In young people with T1DM, PFT was longitudinally associated with retinopathy and early renal dysfunction, highlighting the importance of early glycemic control and supporting the role of metabolic memory in MV complications. Measurement of PFT by ultrasound offers a noninvasive estimate of glycemic burden and tissue glycation.

J Diabetes Sci Technol 2012;6(2):348-355