Journal of Clinical & Translational Endocrinology 8 (2017) 1–5

Contents lists available at ScienceDirect

Journal of Clinical & Translational Endocrinology

journal homepage: www.elsevier.com/locate/jcte

Sense of Coherence is associated with LDL-cholesterol in patients with type 1 diabetes – The PROLONG-Steno study

Kasper Olesen [a,b,*], Troels Mygind Jensen [a,b], Lars Jorge Diaz [a], Anne Cathrine Laustrup Møller [a], Ingrid Willaing [a,b], Valeriya Lyssenko [a,c,d]

[a] Steno Diabetes Center A/S, Gentofte, Denmark
[b] Steno Diabetes Center Copenhagen, Gentofte, Denmark
[c] KG Jebsen Center for Diabetes Research, University of Bergen, Bergen, Norway
[d] Diabetes and Endocrinology, Lund University Diabetes Center, Malmö, Sweden

ARTICLE INFO

Article history:
Received 15 November 2016
Accepted 29 January 2017

Keywords:
Sense of Coherence
Blood-lipids
Diabetes self-management
HbA1c
LDL-C

ABSTRACT

Aim: It is a constant challenge for people with type 1 diabetes to maintain appropriate levels of HbA_{1c}, blood pressure and blood lipids in order to prevent or delay deleterious effects of their illness. This study sought to investigate if Sense of Coherence (SOC) is associated with clinical risk factors in people with type 1 diabetes.

Methods: Questionnaire data, including measure of SOC, was collected from 125 patients with long duration of type 1 diabetes and linked to electronic patient records to obtain clinical measures on HbA1c, blood pressure, and blood lipids. Linear regressions and generalized additive models were applied to explore the associations between SOC and clinical biomarkers.

Results: Mean age of the participants was 60.7 years (standard deviation = 10.0), 44.0% were men. Medium and high SOC were associated with lower levels of LDL-cholesterol ($p = 0.005$). This association was non-linear with medium and high levels of SOC being advantageous whereas low SOC was associated with elevated levels of LDL-cholesterol. Moreover, we observed non-significant tendencies to associations between low SOC and low HDL-cholesterol, and elevated HbA_{1c}.

Conclusions: Findings from this study suggest that high SOC may be protective against elevated LDL-cholesterol among people with type 1 diabetes. Interventions to improve self-management among people with low SOC may prove effective to prevent deterioration of metabolic risk factors.

Introduction

Successful self-management is a cornerstone for people with diabetes in maintaining well-controlled blood glucose levels and preventing elevated blood pressure and dyslipidaemia, which, in the long term increase risk of development of diabetic complications, morbidity and mortality. Despite multifactorial intervention efforts to control these risk factors, there is an unmet need for improving clinical management strategies to prevent diabetes progression and improve professional abilities and quality of life in patients with type 1 diabetes [1].

Sense of Coherence (SOC) is a concept coined by Aaron Antonovsky [2] which constitutes a resource that enables people to cope with life challenges in a health-promoting manner. The concept was originally developed to determine how some people manage to maintain well-being despite chronic or extreme stress exposure. A questionnaire scale to measure SOC, developed by Antonovsky, has been widely used in health research [3]. Higher SOC has been associated with improved self-management in relation to chronic diseases [4], including diabetes [5]. Thus, high SOC is suggested to be protective against development of type 2 diabetes [6,7] and associated with successful lifestyle change in subjects at risk of type 2 diabetes [8]. Among people with diabetes high SOC has been associated with high diabetes-specific self-efficacy [9], prudent food choices and higher physical activity [10], improved glycaemic control measured with HbA1c [11] and decreased risk of complications in men [1]. The SOC concept measures the capacity of an individuals to effectively cope with life events such as chronic disease [12]. Thus, high SOC has been associated with enhanced self-management among people with chronic illness such as; prudent food choices [13], successful lifestyle changes [8,14], and medical adherence [15].Factors that contribute to avoidance of adverse consequences of diabetes.

* Corresponding author at: Steno Diabetes Center Copenhagen, Niels Steensens Vej 6, 2820 Gentofte, Denmark.
E-mail address: Kasper.Olesen@regionh.dk (K. Olesen).

http://dx.doi.org/10.1016/j.jcte.2017.01.003
2214-6237/

SOC may explain why some patients manage to stay free of chronic diabetes complications despite similar disease challenges, while others experience deleterious consequences of their disease. Despite a growing body of research on diabetes management, studies on associations between SOC and diabetes progression are still scarce. Specifically, the association between SOC and clinical biomarkers such as blood pressure and lipid profiles have not yet been studied in patients with type 1 diabetes. Therefore, we aimed to quantify the association between SOC and HbA_{1c} and lipids, respectively in patients with type 1 diabetes and long disease duration.

Material and methods

Study population

The current study is nested within the PROtective genetic and non-genetic factors in diabetic complications and LONGevity (PROLONG) study. Briefly, The PROLONG study (2011–2015) was an observational, multi-Center Scandinavian study of type 1 diabetes patients who despite long diabetes duration of more than 30 years escaped diabetic complications, and patients who developed persistent micro albuminuria or macro albuminuria, proliferative retinopathy or laser treatment, myocardial infarction, stroke or presence of chronic foot ulcer, in the course of 25 years following onset of diabetes. A total of 430 patients attended a clinical examination at one of seven endocrinology/diabetes clinics in Sweden or at the Steno Diabetes Center in Denmark (n = 183), including measurement of anthropometry, biochemistry as well as a questionnaire on family history of diabetes, lifestyle, psychosocial health and social status. The questionnaire used as part of the study visit at the Steno Diabetes Center was modified to include the battery of questions used in calculation of the SOC score. If necessary, participants were offered assistance in completing the questionnaire. To avoid potential reverse causality, i.e. presence of diabetic complications influencing SOC, participants with diabetic complications were not included in the present study, leaving a study sample of 125 patients with long-standing type 1 diabetes but free of complications.

Assessment of Sense of Coherence

SOC was evaluated using the 13-item version of Antonovsky's scale measuring the three dimensions of SOC, which are, meaningfulness, comprehensibility and manageability in a single scale [12]. The SOC scale has been widely used and validated in various cross-cultural settings [3]. The participants were asked to indicate their agreement with each question on a 7-point scale. The 13 individual scores were summarized into a full continuous scale ranging from 13 to 91 with higher scores indicating higher SOC. To improve interpretability of the scale a linear transformation was performed where 0 was made equal to the mean of the population and one unit corresponding to one standard deviation of the population. Previous studies, dividing SOC into tertiles or quartiles, have found non-linear associations between SOC and diabetes management [1]. Thus we anticipated the possibility of non-linear associations between SOC and the outcomes in this study. To account for potential non-linear associations we used SOC as a continuous scale in the statistical models whilst testing models for linearity and when necessary applying models to analyse non-linear associations.

Clinical risk factors

HbA_{1c}, systolic blood pressure, diastolic blood pressure, LDL cholesterol, HDL cholesterol, and triglycerides were measured using routine clinical measurement methods.

Statistical analyses

Descriptive statistics are presented as means (SD). We applied multiple linear regression modelling to study the associations between SOC and clinical risk factors adjusting for possible confounding by sex, age and diabetes duration. Following test for linearity, the associations were analysed using a standard linear regression model. In cases of non-linearity, we applied generalized additive models utilizing splines in order to take non-linearity into account [16]. As the moderate number of participants only allowed for limited flexibility, the non-linear associations were modelled with 3 degrees of freedom. In order to fulfil the requirement for a normal distribution of residual errors, some outcomes (HbA_{1c}, systolic blood pressure, HDL-C, and triglycerides) were log-transformed prior to analysis. All statistical analyses were performed using SAS 9.2 (SAS Institute, Cary NC).

Results

Out of the 183 patients included in the Steno Diabetes Center arm of the PROLONG study, we excluded patients with complications and with missing data on key variables, rendering a population of 120 patients for the current study. Mean SOC score was 71.3 (standard deviation (SD) = 11.5) before transformation of the scale.

Table 1 shows descriptive statistics of the study population. The population was 58% women. More than 75% of the sample reported to be graduates from a higher education and 79% reported to be in a relationship. Only 5% of the population reported sedentary lifestyle. The mean diabetes duration was 41 years (SD = 7.9) and the mean age was 60.7 (SD = 9.6).

Table 2 shows the distribution of clinical risk factors measured in the population. Data on cholesterol and triglyceride was missing for 9 participants. Mean HbA_{1c} was 7.5%, whilst 37 (30%) participants were at or below 7.0% and therefore considered well-regulated according to Danish healthcare guidelines. High variations of blood pressure, cholesterol, and triglycerides were observed.

In linear regression analyses adjusted for diabetes duration and sex, no statistically significant associations were observed between SOC and clinical biomarkers (Table 3). As non-linear associations were observed in models with LDL-C and total cholesterol as outcomes, those results are omitted from Table 3 and instead presented in Fig. 1 only.

Fig. 1 shows the non-linear associations between SOC and the non-transformed outcome variables. The graph shows the combined linear and non-linear impact on SOC with the value 0.0 corresponding to the average impact of SOC on the outcome, i.e. the average participant is used as reference. As seen in Fig. 1e, medium and high SOC is associated with lower levels of LDL-C. Thus, the estimated impact of SOC on LDL-C does not differ between medium and high levels of SOC. A flat or even slightly attenuated LDL-C among participants with highest SOC can also be seen in the figure. This indicates no further impact on LDL-C from increasing SOC

Table 1
Descriptive statistics for the study population (N = 125).

	N	%
Women	70	58
In relationship	93	79
Higher Education	88	75
Active lifestyle (moderate/high level of exercise)	109	95
	Mean	SD
Age (years)	60.7	9.6
Diabetes duration (years)	41.2	7.9
Sense of Coherence (SOC)	71.3	11.5