Are sleep quality and other psychological parameters related to glycaemic variability and glycaemic control? A pilot study

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Introduction

Besides many physical complications, poor psychological wellbeing is highly prevalent in patients suffering from Diabetes Mellitus (DM). Psychological factors like cognitive function, depression and anxiety might be affected. Furthermore, 50% of all patients sleep badly. It is known that poor sleeping quality affects the level of glucose regulation, but there might exist a bidirectional relationship. HbA1c, the gold standard for assessing blood glucose (BG) regulation, appears to be too limited to describe all aspects of blood glucose regulation. Parameters of glycaemic variability (GV) and glycaemic control (GC) are thought to provide a more detailed view on BG regulation. In the present pilot study, we investigated if blood glucose regulation is able to affect sleep quality. We also looked for interactions between glucose regulation and several psychological parameters.

Materials and Methods

Data source

Baseline data was extracted from the MaxABC study, a single centre pilot study performed Máxima Medical Centre. The study was performed amongst 23 insulin dependent adults with poorly regulated type 1 or 2 diabetes. treated with Multiple Daily Injections (MDI) insulin therapy for at least 6 months, consisting of 1-2 injections per day of long-acting basal insulin (Lantus® or Detemir®) and at least 2 injections per day of regular or rapid-acting analogue insulin for meal coverage. Subject should have an HbA1c in the range of 48-86 mmol/mol, with either multiple hypoglycaemic event (glucose <4.0mmol/L, ≥2 per month) or large variability as measured by blood glucose self-measurements at investigator's discretion and HbA1c has remained stable within a range of 12 mmol/mol in the year prior to inclusion to inclusion.

At baseline sleep and other psychological parameters were obtained by using validated questionnaires (figure 1). Participants were subjected to a week of blinded CGM and regular BG measurement to calculate multiple parameters of GV and GC.. Correlation, univariate and multivariate analyses were performed to assess possible relationships

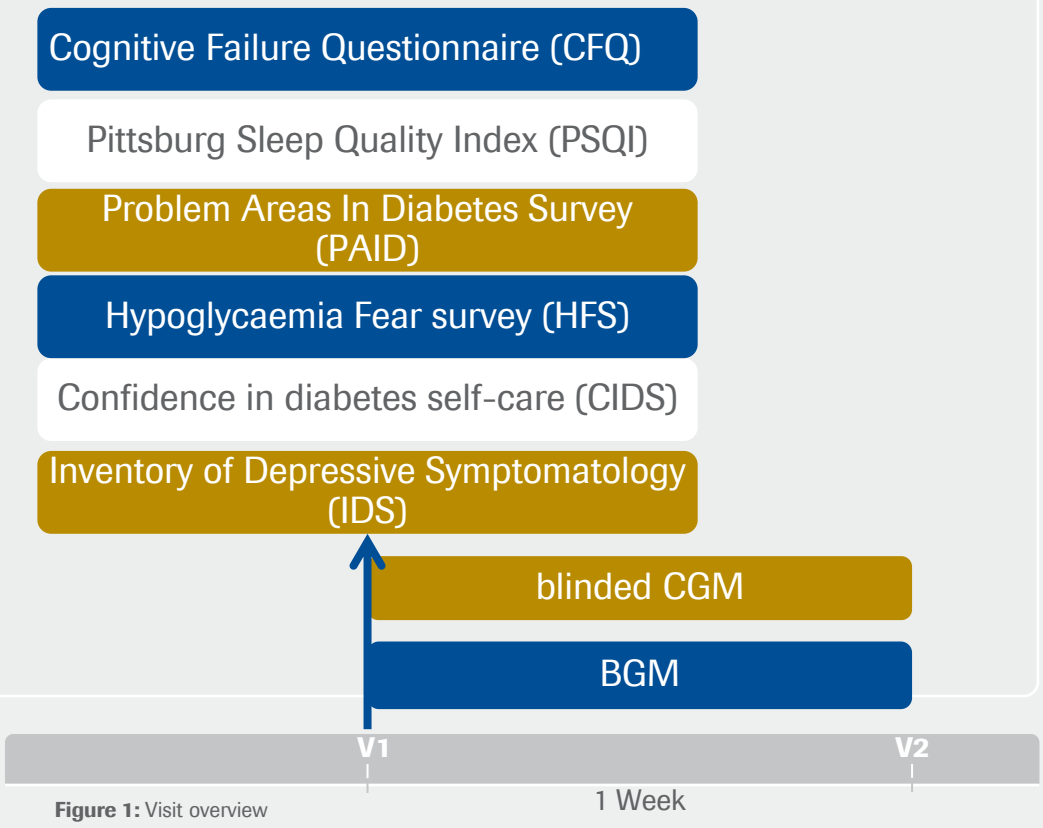

Figure 1: Visit overview

Results

Several interesting interactions between glucose regulation and psychological factors were observed. The most notable regression equations were related to sleep quality, cognitive failure and diabetes mellitus-specific emotional stress These associations were not seen when only assessing Hb1Ac. People who spend more percentage of the time in low range according to the CGM data scored higher on the **cognitive failure** questionnaire, thus having worse cognitive failure. (Figure 2) In addition a significant regression equation was found between participant's **sleep quality** and time spend in hypo-glycaemia. The sleep quality decreased with 0.174 for each percentage point of time spend in hypo-glycaemia(GRADE). So with an increased time in hypo-glycaemia is associated with a lower sleep quality. Both CGM data and SMBG data also confirmed more time spend in hyper- and euglycaemia results in a better sleep quality. The only observed effect of glycaemic variation was on the **diabetes mellitus-specific emotional stress** scores. Less glycaemic variation according to the MAGE was associated with an increase in emotional stress.

Table 1: Patient Characteristics.

Parameter	Outcome
Gender distribution	61% male
Age, Avg (±SD)	54 ± 17 years
BMI, Avg (±SD)	28 ± 5 years
Diabetes duration	17 ± 11 years
Diabetes Type	
Type 1 (%)	12 (52)
Type 2 (%)	8 (35)
Other (%)	3 (13)

Table 2: Linear univariate regression analysis

	R^2	B	P
CFQ x % of time in low CGM values	0.35	-0.76	0.03
PSQI x % hypo according to the GRADE	0.36	0.174	0.02
PAID x MAGE min CGM (in mg/dl)	0,31	1,33	0.05

Conclusions

This pilot showed several interesting association between cognitive failure, sleep quality, diabetes related stress and GC and GV. Given the pilot setting the results would still have to be confirmed in follow-up research. In further research it would be good to look whether improvement in glycaemic variability and control consequently will also results in improvement of the associated psychological outcome.

References

References available on request

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