Risk factors of hypoglycemia in long-standing type 1 and type 2 diabetes

Tamás Várkonyi¹, Szabolcs Nyiraty¹, Fruzsina Pesei¹, Andrea Orosz², Csaba Lengyel¹, György Ábrahám¹, Péter Kempler³

¹University of Szeged, 1st Department of Internal Medicine, Szeged

²University of Szeged, Department of Pharmacology and Pharmacotherapy, Szeged

³Semmelweis University 1st Department of Internal Medicine, Budapest

Introduction

Possible explanations of the relationship between autonomic neuropathy (AN) and hypoglycemia

- Hypoglycemia-induced variability results oxidative stress leading to neuropathy
- Hypoglycemia unawareness frequently develops in AN
- Counter-regulatory response is impaired to hypoglycemia in AN
- Slower gastric emptying in AN is the cause of postprandial hypoglycemia
- Abnormal gastrointestinal peptide release in AN (pancreatic polypeptide, motilin, cholecystokinin)

Aims

- to evaluate the frequency of hypoglycemia
- to analyze the ratio of recognized/unrecognized hypoglycemic episodes
- to measure cardiovascular autonomic neuropathy
- to find possible correlations between frequency and recognition of hypoglycemia and cardiovascular autonomic neuropathy
- to seek for further risk factors and markers of hypoglycemia (HbA1c, BMI, gender, age, disease duration)

in patients with type 1 and insulin-treated type 2 diabetes

Patients

Type of DM:	type 1/insulin-treated type 2
Number of patients:	31
Age: (mean ± SE)	47.1±3. yrs
Duration of DM:	17.2±2 yrs
BMI:	24.2±0.8
HbA1c:	7.7±0.2%

Methods

Determination of autonomic neuropathy

- evaluation of 5 cardiovascular reflex tests

Detection of hypoglycemia

- application of Continuous Glucose Measuring System (CGMS) on 6 consecutive days

Analyzed parameters

- measured and recognized hypoglycemic episodes, HbA1c, BMI, gender, age, disease duration

Conclusion

- 5 hypoglycemic episodes/6 days are expected as an average in a diabetic patient with long standing type 1 or insulin-treated type 2 diabetes.
- less than half of hypoglycemic episodes are realized by patients with type 1 or insulin-treated type 2 diabetes
- the risk of hypoglycemia is increased with the duration of diabetes in insulin-treated patients which was more pronounced in type 2 than in type 1 diabetes
- age, type of diabetes, glycemic control or autonomic neuropathy did not influence the frequency or awareness of hypoglycemic episodes

Results

Frequency of hypoglycemic episodes

Number of measured hypoglycemic episodes /6 days (mean±SE)	Number of recognized hypoglycemic episodes /6 days (mean±SE)	Percentage of recognized hypoglycemic episodes of total (%)
5±0.7	1.98±0.7	42

Correlation between the duration of diabetes and the number of measured hypoglycemic episodes in:

Results of the cardiovascular reflex tests

AN test	diabetic patients (mean±SE)	normal value
Heart rate response to deep breathing (beats/min)	10.53±3.6	≥15
30/15 ratio	1.28±0.08	≥1.21
Valsalva ratio	1.62±0.18	≥1.04
Diastolic RR response to handgrip (mm Hg)	14.93±1.82	≥16
Systolic RR response to standing up (mm Hg)	8.61±1.92	≤10
AN score	2.3±0.34	0

Correlational analysis of hypoglycemic episodes and descriptive parameters of the patients

Correlated parameters	correlation coefficient	p value
AN score-measured hypoglycemic episodes	0.10	0.591
AN score-recognized hypoglycemic episodes	0.26	0.145
Age-measured hypoglycemic episodes	0.06	0.744
Age-recognized/measured hypoglycemia ratio	0.06	0.725
DM duration-recognized hypoglycemic episodes	0.18	0.329
HbA1c-measured hypoglycemic episodes	-0.15	0.412

Comparison of hypoglycemic episodes	type 1 DM	type 2 DM	p value
Measured hypoglycemic episodes (mean±SE)	5.0±0.7	4.9±0.6	0.56
Recognized hypoglycemic episodes (% of total)	43±0.5	43±0.4%	0.85

AN score (mean±SE)	4.6±0.24	1.2±0.24	p value
Measured hypoglycemic episodes (mean±SE)	7±1.6	4.3±0.7	0.157
Recognized hypoglycemic episodes (% of total)	56±7%	36±9%	0.151