DIABETIC FOOT SYNDROME AND COMPENSATION FOR DIABETES MELITUS TYPE I.

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Background

According to WHO diabetic foot is defined as a foot of a patient with diabetes, who is being chronically at risk of infection due to neuropathic, vascular and joint damage, ulcerations, gangrenes, and destruction of deep tissue structures, resulting in amputation of the limb (Frykberg, 2006). Diabetic Foot Syndrome (DFS) and its complications are one of the main reasons for hospitalization of the patients with diabetes. This is significantly involved in increasing morbidity and mortality of these patients. In the USA and in Europe it is the most common nontraumatic cause of limb amputation (Kopal, Kopalová, 2011). In 2013 were 8000 diabetics with an amputated leg in Slovakia (Rončáková, 2013). Altogether in Slovakia are 336 000 diabetics, out of whom approximately 30 000 to 45 000 suffer DFS (Šušková, 2011). DFS is the direct consequence of chronic complications of diabetes I. and II, diabetic polyneuropathy and angiopathy. As a matter of prevence of diabetic foot it is very important to cure the diabetes itself, as well as, to keep the glycated hemoglobin HbA1c level in the norm.

Aim

The main aim of the conducted research was to find out if there exist the relation between DFS and the state of compensation of diabetes type I. as represented by HbA1c values.

A set of respondents

The research included 378 respondents, patients with diabetes type I with the diabetic foot diagnosis, hospitalized in FNsP FDR in Banská Bystrica (SVK) in the 2nd surgical clinic during the period from 1.1.2012 to 31.12.2016. The respondents were included in the research regardless of age, gender and social status.

Methods

The applied research method was a retrospective study of the medical records of the chosen patients. The choice of patients was deliberate and targeted. From the medical records were gained demographic information, the information about the course of diabetes treatment and the information on patient´s compliance with regimens and treatment regimens. The verification of compensation, respectively, decompensation of diabetes were tracked in the values of glycated hemoglobin (HbA1c). For data analasis were used statistical methods: average, modus, median, minimum, maximum, chi quadrate test, Kruskal – Wallis test, D
´Agostin test, Mann – Whitney test, T – test.

Results

Table 1 Compositon of respondents by gender and age

	n	*d*	*std*	*modus*	*med*	*min*	*max*
women	274	68,8	10,05	66	68	28	102
men	104	67,97	11,5	63	67	37	90
in sum	378	68,57	10,46	66	68	28	102

Table 2 Duration of diabetes in years with regard to respondents' gender.

duration DM/in years	*d*	*std*	*modus*	*median*	*min*	*max*
women	7,55	3,52	8	7	1	16
men	7,15	3,32	5	7	2	15
in sum	7,44	3,47	8	7	1	16

Table 3 Duration of DFS in months

duration of DFS	*d*	*std*	*modus*	*median*	*min*	*max*
in months	39,52	24,76	32	35	3	121

Incidence of associated diseases is realted to duration DM. $p=4,553.10^{-16}$

HbA1c

DCCT standardization (according to the Diabetes Control and Complications Trial study) – standard is to 6,0 %. IFCC standardization (International Federation of Clinical Chemistry and Laboratory Medicine) – standard values for healthy persons are withing 2,8 to 4,0 %.

Current criteria

In common clinical practice is generally accpeted recording of HbA1c values according to DCCT standardization.
The relation between the HbA1c value and the risk of developing the chronical diabetes complications:

- Common risk: HbA1c ≤ 6,5 %.
- Macrovascular risk: HbA1c > 6,5 %.
- Microvascular risk: HbA1c > 7,5 %.

The values reported in our set are the average of the five values recorded within the five respondent´s controls in the diabetological ambulance.

Table 4 HbA1c values with regard to respondent´s gender.

HbA1c	*d*	*std*	*modus*	*median*	*min*	*max*
women	8,94	2,73	5,2	7,6	2,8	15
men	7,64	2,78	3,5	8,05	3,2	15
in sum	7,59	2,73	8,6	7,6	2,8	15

All the recorded values of HbA1c for respondents exceed expert recommended values.

Table 5 Statistical relation of glycemia & gender of respondents

Test ($\alpha = 0,05$)	*test statistics*	*critical points*	*p value*
Mann – Whitney	Z	W	P
glycemia (gender)	-0,3041	(-∝; -1,6449>	0,3805

Measured blood glucose values o f the respondents are not dependant on their gender.

Table 6 HbA1c values with regard to respondents´ age

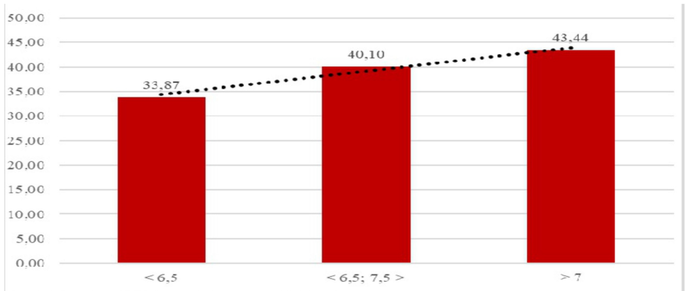
HbA1c	*d*	*std*	*modus*	*median*	*min*	*max*
> 25;45)	11,04	2,91	nie je	10,2	8,4	15
< 45;65)	7,61	2,75	7,6	7,6	3	14,8
< 65;80)	7,55	2,63	5,2	7,6	2,8	14,3
≥ 80	7,4	2,96	5	7,6	3	15

The highest HbA1c values were measured within the group of respondents aged from 25 to 45. The average gained value was 11,4 %. Following group, aged from 45 – 65 years (7,61 %), and age group from 65 – 80 years (7,55 %). The lowest HbA1c values gained the oldest respondents aged over 80 (7,40 %).

Table 7 Statistical relation of glycemia & gender of respondents

Test ($\alpha = 0,05$)	*test statistics*	*critical points*	*p value*
Kruskal – Wallis	K	K_{krit}	P
glycemia (age)	0,7513	5,9915	0,6868

Measured glycemy values of respondents were dependant on their age.



Graph 1 Duration of DFS (in months) to average HbA1c values.

The value representing the durtion of DFS, has an increasing tendency with increasing HbA1c.

Table 8 Statistical relation of glycemia & duration of SDN

test ($\alpha = 0,01$)		*test statistics*	*p value*
Mann –Whitney		**z**	**p**
SDN	< 6,5 a <6,5; 7,5>	-1,224	0,1112
SDN	<6,5; 7,5> a > 7,5	1,063	0,1446
SDN	< 6,5 a > 7,5	3,8341	0,0006

In patients with the avarage HbA1c values higher than 7,5 %, lasts DFS statistically significantly longer, to the patients, whose HbA1c values are lower than 6,5 % (significance p > 0,001).
Duration of the Diebetic Foot Syndrome of respondents is related to patient´s HbA1c values.

Discussion and conclusion

A good metabolic compensation for diabetic patients suffering type I. (unless frequent hypoglycaemia is present) is represented by the HbA1c values of 6,2 % – 7,5 %. All the measured values of glycated hemoglobin in our respondents exceed expert recommended levels of HbA1c. Functionality between HbA1c values and the duration of DFS was confirmed. According to Vilímovský (2013), high blood sugar level of diabetic patients, damages large vessels and frequently the most effected are lower limb arteries. The conducted study did not confirm the relation of HbA1c values and age, respectively, gender of respondents. Neither according to Barák (2014), factors influencing the glycated hemoglobin levels are not age or the patient´s gender, but the correct setting of the patient for the treatment, efective education from the onset of the disease, the actuality, how patient´s surrounding participates on solving the problem, more importantly, patient´s approach to the treatment. Also according to Doničová (2011), among the factors, influencing HbA1c values do not belong patient´s age or the gender, but physical activity, diabetic diet, sight, kidneys and leg care. The research confirmed the occurance of associeted diseases in respondents, which can be considered chronic diabetes complications, depending on the duration of Diabetes mellitus. The longer the patients suffer diabetes and do not keep the diabetic regime, the more severely compromised by the occurrence of chronic complications they are. Chronic complications include: diabetic nephropathy, retinopathy, neuropathy, ischemic heart disease, sudden vascular stroke, myocardial infarction and ischemic disease of the lower limbs (Schroner,2004). The reserch unequivocally demonstrated the dependence between the HbA1c values and the occurance of DFS for patients with diabetes type I. Based on these findings, we suggest the following recommendations for practice:

Recommendations for practice

One of the preconditions for prevention of outbreak of the Diabetic Foot Disease is the continous compensation of Diabetes Mellitus disease type I. Indicator of compensation is HbA1c level. The effective education therefore must focus on a long-term retention of balanced level of HbA1c

- To provide thorough education of a patient with diabetes from the onset of the disease regarding the adherence to the principles of therapy, healthy lifestyle and diet regime.
- To increse awareness of disease management not only for patients but also for their family members.
- To provide the patient with oral but also written information. To check the undrstanding of information through the feedback.

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