International Heart and Vascular Disease Journal
Volume 5, Number 15, September 2017

Journal of the Cardioprogress Foundation

Characteristics of glycaemic status and cardiovascular complications in relation to education level in patients with diabetes mellitus type 2

Mehdiyev S.Kh.
Azerbaijan State Advanced Training Institute for Doctors named after A. Aliyev

Authors

Samir Kh. Mehdiyev, M.D., Ph.D., associate professor of the department of internal medicine, Azerbaijan State Advanced Training Institute for Doctors named after A. Aliyev.

Summary

Objective

To investigate the relation between education level, glycaemic status, and cardiovascular complications and their electrocardiogram (ECG) criteria in patients with diabetes mellitus type 2 (DM 2).

Materials and methods

This study included 523 patients with DM2. Patients underwent questioning that allowed to estimate their education level and obtain information about the presence of arterial hypertension (AH), coronary heart disease (CHD), chronic heart failure (CHF), and history of myocardial infarction (MI). Apart from it, we performed ECG registration in order to detect left ventricular hypertrophy, MI and CHD, and estimated fasting levels of glucose and glycated hemoglobin in venous blood.

Results

Systolic AH was more frequently present in patients with incomplete secondary education comparing with the patients with higher education, and diastolic AH was more frequent in persons with vocational education. Use of ROSE questionnaire allowed to detect angina pectoris 2.5 times more frequently comparing with routine patient's questioning, and ECG identified signs of precedent MI 2 times more frequently than normal questioning. Patients with secondary education demonstrated significantly lower occurrence of MI history, various arrhythmias and CHF, and ECG signs of MI were more frequent in patients with secondary and vocational education, in comparison with patients with higher education ($p<0.05$). We identified reverse correlation between education level and

* Corresponding author. Tel.: +9940513744890. E-mail: smehdiyev@mail.ru

glycemia in persons with secondary education comparing with the patients with higher education (76.3±2.9% and 64.8±3.7%, respectively, p<0.05). The least favorable control of disease progression was found in patients with incomplete secondary education (55.5±8.2%), and the most favorable one was demonstrated by patients with secondary education (14.2±2.4%).

Conclusion

It is necessary to perform adequate control of disease progression and improve risk factors' management in all patients with DM 2 independently from their education level in order to prevent cardiovascular complications.

Key words

Diabetes mellitus type 2, education level, glycaemic status, cardiovascular complications.

Introduction

Education level is considered to be a significant modifiable and non-modifiable risk factor (RF) that influences the health of population [1, 2, 3, 4]. Although results of numerous studies that proved the influence of education on cardiovascular complications have been published in scientific literature, this relation has never been studied in patients with diabetes mellitus type 2 (DM2) depending on their gender[5, 6, 7, 8, 9].

It is known that education level influences lifestyle, smoking, obesity and other RF in people of both genders, and this, in its turn, increases the risk of complications in patients with DM2 [6]. There are enough evidences of direct correlation between education level and health condition of patients [4, 6, 9]. Education status significantly reduces the risk of DM2 and arterial hypertension (AH) development in women, but not in men. Women with secondary education had elevated both AH occurrence and BMI, consequently, it increases the risk of coronary heart disease (CHD) development. It is known that men with low education have 7-8 times higher risk of cardiovascular pathology development [6].

Efficacy of antihypertensive therapy is lower in men with higher education having tachycardia and obesity and consuming excessive amount of alcohol [5]. Other studies demonstrated direct correlation between education level and AH just in young women [6].

The level of education has negative correlation with cardiovascular complications and influences also the lifespan. Thus, men with higher education have longer lifespan in respect to men with secondary education. Although men's lifespan has increased during the last 25 years comparing with women, its gender differences in relation to education levels have not been studied [10]. During the last years it has been noticed that that people with lower education level had shorter lifespan, and it was tightly connected with social conditions and complications, in particular, with cardiovascular ones [9].

It is worth to mention that smoking and its bad impact are more frequent in people with low education level that, in its turn, increases the risk of cardiovascular disease development and progressing of their complications [10].

High frequency of cardiovascular complications in people with low education level can be explained by their restricted knowledge about negative influence of RF. At the same time, during the last years the level of knowledge about preventive measures in women has increased comparing with men [7]. Education level increases the risk of cardiometabolic changes, and it is differently regulated in men and women. The frequency of cardiovascular complications is different between both genders [6].

Taking into account the facts mentioned above, we aimed to study the correlation between education level and cardiovascular complications in patients with DM2.

Materials and methods

This study involved 523 patients aged 30-69 who were admitted to endocrinological department of the Republican Clinical Hospital named after Mirkasimov or who had to visit endocrinologist at the Republican Clinical Hospital outpatient department or Republican endocrinological center. 165 patients (31.5%) were males, and 358 (68.5%) were females. Average age of patients was 53.9±0.4 years.

All patients had to fill ARIC questionnaire established by the World Health Organization (WHO) professionals and being used for clinical epidemiological studies. This questionnaire contained a section dedicated to educational status of patients. All patients underwent blood pressure (BP) measurement us-

ing mercury sphygmomanometer with accuracy of 2 mm Hg in sitting position for two times with 5-minute break between them. For further analysis we used an average value of three BP measurements.

All patients filled ROSE questionnaire that reported the presence of stable angina, AH, CHD, the history of myocardial infarction (MI), and chronic heart failure (CHF). AH was diagnosed if BP levels were ≥140/90 mm Hg, left ventricular hypertrophy (LVH), MI and CHD were diagnosed using electrocardiography (ECG) criteria. 24-hour ECG monitoring was used for arrhythmias diagnosis, and CHF was diagnosed based on transthoracic echocardiography results.

Blood used for glycaemic status determination was taken from cubital vein. If glucose concentration in blood was ≥7 mmol/L, hyperglycemia was considered, and glycated hemoglobin concentration ≥7% indicated inadequate DM control.

Results

It is known that AH is the most studied complication of DM2 (Table 1). It was demonstrated that patients with DM2 and higher, professional and secondary education had the same frequency of AH, and the lowest frequency of AH was present in people with incomplete secondary education. At the same time no one of them had statistically significant values.

Although the patients with DM2 and incomplete secondary education had lower occurrence of AH, they had ECG signs of LVH more often ($p>0.05$). The highest occurrence of systolic AH was found in the patients with DM2 and incomplete secondary education comparing with the people having higher education ($p<0.05$). Even if the occurrence of AH in patients with higher education, systolic AH was present in few patients. Diastolic AH was less common in patients with higher education, and its frequency was lower comparing with people with professional education.

According to the questionnaires, stable angina was the least frequent in patients with university education, and it was 2.5 higher if assessed with ROSE questionnaire. The frequency of this CHD form was relatively lower in patients with DM2 and higher education comparing with the patients with secondary and professional education.

ECG signs of CHD were present in 10.6% of patients, but these characteristics had no statistically significant difference between groups of patients with different education levels.

Questioning revealed MI in every one out of ten patients, and every fifth one had ECG signs of MI. Instrumental examination and patients' history demonstrated that the lowest number of MI was found in patients with secondary education, and comparing with the people with higher education this difference was statistically significant.

The biggest number of arrhythmias was detected in patients with DM2 and higher education, and the lowest one was found in people with secondary education.

The same situation was fair for patients with CHF, since 1/3 part of patients had its clinical and echocardiographic signs, and people with university education had relatively higher frequency of this condition comparing with the people with secondary education ($p<0.05$).

Table 1. **The occurrence of glycemia, cardiovascular complications and their ECG criteria depending on education level (%)**

Characteristic	Higher education (n=165)	Professional education (n=111)	Secondary education (n=211)	Incomplete secondary education (n=36)
AH	80±3.1	82.8±3.5	80.1±2.7	69.4±7.7
CHD (angina)	6.7±1.9	13.5±3.2	14.2±2.4**	11.1±5.2
Stable angina (ROSE questionnaire)	16.3±2.8	27.0±4.2*	22.3±2.8	16.6±6.2
MI	9.7±2.3	4.5±1.9	3.3±1.2**	5.5±3.8
Arrhythmia	15.1±2.8	11.7±3.0	8.5±1.9**	13.9±5.7
CHF	33.9±3.7	27.0±4.2	22.3±2.8**	22.2±6.9
LVH (ECG)	71.5±3.5	64.8±4.5	62.5±3.3	72.2±7.4
MI (ECG)	21.2±3.2	10.8±2.9*	11.4±2.2**	16.6±6.2
CHD (ECG)	12.7±2.6	14.4±3.3	11.4±2.2	13.9±5.7
Glycemia (≥7mmol/l)	64.8±3.7	66.6±4.4	76.3±2.9**	77.7±6.9
HbA1c (≥7%)	33.9±3.7	20.7±3.8*	14.2±2.4**	55.5±8.2***
Systolic AH	49.1±3.9	56.7±4.7	54.0±3.4	66.6±7.8***
Diastolic AH	30.9±3.6	42.3±4.8*	32.7±3.2	36.1±8.0

Comment: * - Difference between patients with higher and professional education ($p<0.05$); ** - Difference between patients with higher and secondary education ($p<0.05$); *** - difference between patients with higher and incomplete secondary education ($p<0.05$).

There was a negative correlation between education level and glucose concentration in blood. Inadequate glucose control (plasma levels ≥7 mmol/L) were more frequent in patients with incomplete secondary education and present the least in patients with higher education. Comparison of this parameter between patients with DM2 and higher education and patients with DM2 and secondary education was statistically significant.

It is interesting to notice that the highest values of poorly controlled glycaemia were detected in people with incomplete secondary education, and relatively good control of glycaemia was characteristic for patients who had higher education. Inadequate glycemic control was present in 1/3 part of patients with DM2 and higher education and in 1/5 part of patients with professional education. The difference between HbA1c levels was statistically significant depending on education levels. Patients with DM2 and higher education had poorer glycemic control comparing with the patients with DM2 and professional or full secondary education, whereas patients with incomplete secondary education had relatively good glycemic control.

Discussion

It is known that AH is one of the most frequent concomitant diseases in patients with DM2 [5, 8]. Our results were a bit controversial, and they demonstrated that education level did not change significantly AH prevalence. But it is worth to notice that the studies mentioned above were performed in patients with AH without DM2 [5, 8]. Educated patients had no adequate DM compensation, apart from it preventive measures aiming to target RF have not been performed in this group, and in the end it has led to significant increase of AH prevalence.

The probability of low AH frequency in people with incomplete secondary education can be explained by their high physical activity, and high AH values can be explained by the lack of knowledge about the presence of disease and consequent insufficient therapy. According with our results, this trend was exactly the opposite in the patients with higher education.

ECG signs of LVH were a frequent pathology between the patients of this study. LVH prevalence in general population is around 16-19%, and in patients with AH this value is above 60% [11]. The frequency of LVH in our population was 67.7% independently from education level, and it raises particular concerns. It is known that the risk of arrhythmias, CHF, sudden death and other cardiovascular complications is high enough in patients with LVH, and it requires performing immediate preventive measures [12, 13].

Stable angina was detected 2.5 times more often if the ROSE Angina questionnaire was used, comparing with routine history taking. In this questionnaire patients have to answer particular questions that facilitate establishing the diagnosis. Low detection of CHD in people with higher education can be explained by sufficient knowledge about the complications of this disease, by more precise following a hypolipidemic diet, by adequate actions against RF. Taken together, these things indicate that these people followed healthy lifestyle.

ECG signs of myocardial infarction were detected 2-3 more often that can be explained by diabetic cardiomyopathy [14]. Although clinical manifestations of MI was less present in the history of patients with secondary education comparing with the other groups, the frequency of MI ECG symptoms was 3 times higher. These results demonstrate that painless forms of CHD prevails over clinical manifestations of MI in patients with DM2 [15, 16, 17]. It can be explained by the fact that CHD is more often diagnosed in educated people and that preventive measures are well-timed in this group of patients. Our results can be proved by similar studies that have been conducted in past [6, 7, 9].

Frequent detection of arrhythmias in patients can be explained not by improved education level but by early diagnosis of this pathology. The frequency of CHF in patients with DM2 goes up together with the increase of education level, and it stimulates developing preventive programs.

Table 1 demonstrates reverse correlation between venous blood glycaemia and HbA1c levels. It proves once more the fact that the control of DM course should be performed using HbA1c levels. The worsening of DM control with the increase of education level can be considered negative, and it does not go along with other studies that have been conducted in other regions [6].

Conclusion

Thus, reasonable correlation between education level and cardiovascular complications were not detected in the studied cohort of patients. Otherwise, it is recommended to improve DM2 RF prophylaxis independently on patients' education in order to prevent cardiovascular complications and perform adequate glycemic control.

Conflict of interest: None declared.

References

1. Hajian- Tilaki K., Heidari B. The link between BMI and waist circumference in northern Iranian adults. East African Journal of Public Health, 2010;32:202-209.
2. McLaren L. Socioeconomic status and obesity. Epidemiologic Reviews, 2007;29:29-48.
3. West Suitor C., Kreak VI. Adequacy of evidence for physical guidelines development: workshop summary, 2007.
4. Salonna F., van Dijk JP., Geckova AM. et al. Social inequalities in changes in health-related behavior among Slovak adolescents aged between 15 and 19: a longitudinal study. BMC Public Health, 2008;8: p. 57.
5. Timopheeva TH, Deev AD, Shalnova SA. et al. The analytical inquiry on an epidemiological situation on an arterial hypertension in 2008 and its dynamics with 2003 for 2008 on three spent monitorings. M.: 2008; p.12. Russian
6. Kautzky-Willer A., Dorner A., Jensby A., Rieder A. Women show a closer association between educational level and hypertension or diabetes mellitus than males: a secondary analysis from the Austrian HIS. BMC Public Health, 2012;12: p. 392.
7. Stroebele N., Muller-Riemensehneider F., Nolte C.H. et al. Knowledge of risk factors and warning signs of stroke: a systematic review from a gender perspective. Int. J. Stroke, 2011;6:60-66.
8. Mamedov MN, Chepurina NA. Total cardiovascular risk: from the theory to practice. M.; 2007; p. 23. Russian
9. Deboosere P., Gadeyne S, Oyen HV. The 1991-2004 evolution in life expectancy by educational level in Belgium based on linked census and population register data. European J. of Population, 2009;25:175-196.
10. Bronnum-Hansen H., Boadsgaard M. Widening social inequality in life expectancy in Denmark. A register-based study on social composition and mortality trends for the Danish population. BMC Public Health, 2012;12: p. 994.
11. Oikarinen L, Karvonen M. et al. Electrocardiographic assessment of left ventricular hypertrophy with time-voltage QRS and QRST wave areas. J. Hum. Hypertension, 2004;18(1):33-40.
12. Shenasa M., Shenasa H., El-Sherif N. Left ventricular hypertrophy and arrhythmogenesis. Card. Electrophysiol. Clin., 2015;7(2):207-220.
13. Raggi P. Left ventricular size as a predictor of vascular events. Atherosclerosis, 2015;240(2):398-9.
14. Alexandrov AH. Coronary artery disease and diabetes mellitus //ECS RAMS.-2004; p. 36. Russian
15. Nagaeva YM, Sayfutdinov RG. Silent myocardial ischemia. Practice medicine, 2008:4. Russian
16. Mitkovskaya NP, Terekhov VI, Avdey LL, Pateyuk IV. Silent myocardial ischemia - a way to the diagnosis. Journal of medicine, 2008;3(25):12-15. Russian
17. Sejil S., Janand-Delenne B., Avierinos J.F. et al. Six-year follow-up of a cohort of 203 patients with diabetes after screening for silent myocardial ischemia. Diabet Med. 2006;23(11):1186-1191.