PREDICTORS OF NO-REFLOW PHENOMENON: DIABETES MELLITUS TYPE II AND OBESITY AND THEIR ASSOCIATED MORTALITY IN STEMI PATIENTS AFTER PRIMARY PCI

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Rezumat

Decelarea fenomenului no-reflow în urma PCI primar la pacienții cu STEMI reprezintă un factor de risc negativ pe termen scurt și lung în ceea ce privește supraviețuirea comparativ cu pacienții care nu asociază fenomenul. Acest fapt este cu atât mai important în ceea ce privește mortalitatea pacienților cu cât s-a dovedit că există o corelație între fenomenul no-reflow și diabetul zaharat de tip II și obezitate.

Cuvinte cheie: fenomenul no-reflow, diabet zaharat, obezitate

Abstract

The prognosis of STEMI patients experiencing the no-reflow phenomenon is unfavorable both in the short- and long-term compared to patients who do not develop this pathology, and it is even worse as other cardiovascular risk factors. There is a correlation between the no-reflow phenomenon and diabetes mellitus type II and obesity and these conditions represent strong predictors of mortality.

Keywords: no-reflow phenomenon, diabetes mellitus, obesity

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Introduction

The no-reflow phenomenon is met by percutaneous coronary intervention in patients who have had a ST segment elevation myocardial infarction, the failure of blood flow to the coronary microcirculation despite the effective disintegration of the artery involved⁽¹⁾.

Diabetes mellitus is a heterogeneous group of disorders with significant lipid and protein-related consequences, with hyperglycaemia. At macrovascular level there is an alteration of medium and small blood vessels resulting from the association of several cardiovascular risk factors. Myocardial ischemic suffering is caused by the occurrence of macroangiopathy involving atherosclerotic pathology, microangiopathy where small diameter vessels and dismetabolic myocardiopathy⁽²⁾.

Obesity contributes directly to the alteration of glucose and lipid metabolism, favoring the development of atheromatous plaques, which is mainly explained by the production of negative proinflammatory elements⁽³⁾.

The prognosis of STEMI patients experiencing the no-reflow phenomenon is unfavorable both in the short- and long-term compared to patients who do not develop this pathology, and it is even worse as other cardiovascular risk factors⁽⁴⁾.

Objectives

Highlighting the impact of type II diabetes mellitus and obesity on coronary microcirculation compared with people who do not have this pathology, meaning an important element in determining acute myocardial infarction with subsequent post-angiographic development of the no-reflow phenomenon.

Material and method

A study was conducted which included 656 patients with ST segment elevation acute myocardial infarction, admitted to the Cardiology Clinic of Oradea County Emergency Clinical Hospital between 01.01.2016 and 31.03.2018, who were revacculated myocardial with primary PCI. The no-reflow phenomenon after angiography was observed in 96 patients, of whom 42 had type II diabetes. Patients were evaluated both clinically and paraclinically by weighing, electrocardiography before and after PCI, angiographic, echocardiographic and biological. Basal blood glucose values were monitored for both known diabetic patients and those with over-normal values, and glycosylated hemoglobin was determined in patients who had repeatedly elevated glycemic levels or in known diabetic patients. Thus, the STEMI and diabetes diagnosis was established following the anamnesis and the objective examination as

Diabetes mellitus	Normal flow		No-reflow		Incidența No-reflow
	Nr.	%	Nr.	%	
Whitout Diabetes	415	74,11	54	56,25	11,51
With Diabetes	145	25,89	42	43,75	22,46
Diabetes mellitus insulin-dependent	69	12,32	15	15,63	17,86
Diabetes mellitus non insulin- dependent	76	13,57	27	28,13	26,21

Table 1. Incidence of no-reflow phenotype in type II diabetes mellitus

Figure 1. Distribution based on diabetes

Obesity	Normal flow		No-reflow		Incidența No-reflow
	Nr.	%	Nr.	%	
Normal weight	346	61,79	50	52,08	12,63
Obese	214	38,21	46	47,92	17,69
Obese gr.1	91	16,25	16	16,67	14,95
Obese gr.2	94	16,79	22	22,92	18,97
Obese gr.3	29	5,18	8	8,33	21,62

Table 2. The incidence of no-reflow phenomenon depending on obesity

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well as after the paraclinical investigations. According to current guidelines, diabetes mellitus is considered if type II diabetes is considered to be > 126 mg / dl and glycosylated hemoglobin $> 6.5\%$ ⁽⁵⁾, and obesity is determined from a BMI ≥ 30 kg / m²⁽⁶⁾.

Statistical analysis

The statistical analysis was performed using SPSS 19. We calculated frequency ranges, odds ratio (OR) and 95% confidence interval. The statistical significance was attributed to $p < 0.05$ value.

Results

Diabetes mellitus was recorded in 1: 4 of the patients in the Normal flow group and in almost 1: 2 of the patients in the No-reflow group ($p = 0.001$). Insulin-dependent diabetes had a lower insignificant frequency in the Normal flow vs. the No-reflow group (12.32% vs. 15.63%, $p = 0.370$), whereas the prevalence of non-insulin-dependent diabetes was significantly lower in patients in the Normal flow group (13.57% vs. 28.13%, $p < 0.001$). The incidence of no-reflow was 11.51% in non-diabetic patients, significantly lower than in diabetics (22.46%, $p = 0.001$), especially in non-insulin dependent diabetics (26.21%, $p < 0.001$). The risk of no-reflow phenomenon is nearly 2 times higher in diabetics than non-diabetics (OR = 1.951, 95%

CI: 1.353-2.813, $p < 0.001$), the risk being higher for non-insulin-dependent diabetics = 2.277, 95% CI: 1.511-3.430, $p < 0.001$). For insulin-dependent diabetics, the no-reflow risk is 1.6-fold higher than for nondiabetics (OR = 1.551, 95% CI: 0.916-2.616, $p = 0.010$). Obesity was present in 38.21% of normal flow patients and 47.92% of patients in the No-reflow group ($p = 0.073$). The prevalence of 2 and 3 obesity was significantly higher in No Reflow patients than in Normal flow group (31.25% vs 21.97%, $p = 0.047$). The risk of the no-reflow phenomenon is 1.4 times higher in obese patients than in normoponderals (OR = 1.401, 95% CI: 0.969-2.059, $p = 0.073$), the risk being higher for ob 2 3 (OR = 1.502, 95% CI: 0.704-1.994, $p = 0.081$, OR = 1.551, 95% CI: 0.916-2.616, $p = 0.010$). Mortality in patients with diabetes was significantly higher than in non-diabetic patients (21.43% vs 9.26%, $p = 0.026$). The risk of postPCI death in diabetic patients 2.7-fold greater than nondiabetics (OR = 2.6727, 96% CI: 0.822-8.689). Regarding normoponderal, ob 2 and 3 obesity represent a postPCI mortality risk factor (OR = 2,000, 95% CI: 0,482-8,307, $p = 0,033$ in obesity gr.2, OR = 5,400, 95% CI: 0.983-29.668, $p = 0.025$ on obesity gr. 3).

Discussions

This study demonstrates a link between Type II diabetes associated with varying degrees of

Figure 2. The incidence of no-reflow phenomenon depending on obesity

Diabetes mellitus			
No	54	5	9,26
Yes	42	9	21,43
Diabetes mellitus type II ID	15	3	20,00
Diabetes mellitus type II NID	27	6	22,22
Obesity			
No	50	5	10,00
Yes	46	9	19,57
Obese gr.1	16	2	12,50
Obese gr.2	22	4	18,18
Obese gr.3	8	3	37,50

Tablel 3. Mortality depending on the association of type II diabetes and obesity

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affection and no-reflow phenomenon. The study also notes the link between the rise of the no-reflow phenomenon correlated with the presence of diabetes and obesity with increased mortality risk in these patients. Furthermore, the study may be associated with other studies that have emphasized that the presence of a history of myocardial infarction correlated with the presence of these cardiovascular risk factors may be a predictor of the occurrence of the no-reflow phenomenon⁽⁷⁾.

Conclusions

Unlike other studies in the field, it emphasizes the importance of systematically performing basal glycaemia followed by glycosylated hemoglobin, as well as BMI in the risk of detecting the no-reflow phenomenon and mortality compared to patients who do not associate these pathologies.

Bibliography

1. Camici PG, Crea F. Coronary microvascular dysfunction. *The New England journal of medicine*, 2007, 356(8):40-830
2. Gherasim și colab. *Medicină internă, Volumul II Bolile cardiovasculare metabolice*, Ed. Medicală, București 1998; 1167-1297
3. Ionescu DD. Factorii de risc și ateroscleroza. Mereuță A. Cateterismul cardiac și angiografia cardiacă și coronariană. Bucșa A, Deleanu D. *Intervențiile coronariene percutane*. Ginghină C, Călin A. *Infarctul miocardic acut*. În: Apetrei E, Cuculici GhP, Gheorghiu AW. *Cardiologie clinică, București, Edit. Medicală Callisto 2015; 69-79, 227-241, 476-516, 517-541.*
4. Tatu-Chițoiu G, Tatu-Chițoiu A, Lăcău S. *Electrocardiograma în reperfuzia miocardică*, Edit. Medicală Antaeus, București, 2014, pag. 333
5. Authors/Task Force Members¹, Rydén L, Grant PJ, Anker SD, Berne C, Cosentino F, Danchin N, Deaton C, Escaned J, Hammes HP, Huikuri H, Marre M, Marx N, Mellbin L, Ostergren J, Patrono C, Seferovic P, Uva MS, Taskinen MR, Tendera M, Tuomilehto J, Valensi P, Zamorano JL; ESC Committee for Practice Guidelines (CPG), Zamorano JL, Achenbach S, Baumgartner H, Bax JJ, Bueno H, Dean V, Deaton C, Erol C, Fagard R, Ferrari R, Hasdai D, Hoes AW, Kirchhof P, Knuuti J, Kolh P, Lancellotti P, Linhart A, Tamargo JL, Torbicki A, Wijns W, Windecker S; Document Reviewers, De Backer G, Sirnes PA, Ezquerro EA, Avogaro A, Badimon L, Baranova E, Baumgartner H, Betteridge J, Ceriello A, Fagard R, Funck-Brentano C, Gulba DC, Hasdai D, Hoes AW, Kjekshus JK, Knuuti J, Kolh P, Lev E, Mueller C, Neyses L, Nilsson PM, Perk J, Ponikowski P, Reiner Z, Sattar N, Schächinger V, Scheen A, Schirmer H, Strömberg A, Sudzhaeva S, Tamargo JL, Viigimaa M, SC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD, The Task Force on diabetes, pre-diabetes, and cardiovascular diseases of the European Society of Cardiology (ESC) and developed in collaboration with the European Association for the Study of Diabetes (EASD). *European Heart Journal* 2013, 39(34): 87-3035
6. Yumuk V, Tsigos C, Fried M, Schindler K, Busetto L, Micic D, Toplak H. *European Guidelines for Obesity Management in Adults*. *European Journal of Obesity*, 2015, 6(8):402-424
7. Smyth A., O'Donnell M., Lamelas P., Teo K., Rangarajan S., Yusuf S.. Physical activity and anger or emotional upset as triggers of acute myocardial infarction: The INTERHEART Study. *Circulation* 2016; 15(134):1059-1067