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High incidence of hyperglycemia and type 2 diabetes in subjects with acute coronary syndrome (ACS)

High blood glucose concentration may increase risk of death and poor outcome after acute myocardial infarction. Stress hyperglycemia is associated with an increased hospital mortality in patients with or without diabetes (1). Acute rather than the chronic pre-existing glycometabolic state accounts for the prognosis in acute coronary syndrome. Admission hyperglycemia in patients with acute coronary syndrome may be even a stronger risk factor than a previous history of diabetes (2–4). There was no detectable glycemic threshold for these adverse effects. The prognostic correlates of admission glycemia were unaffected by diabetic status and did not differ significantly between patients with acute myocardial infarction and those with unstable angina (3).

Recent data revealed that patients with myocardial infarction have a high prevalence of previously unknown *diabetes mellitus* and impaired glucose tolerance. Abnormal glucose tolerance is also a strong risk factor for future cardiovascular events after myocardial infarction. Since it is common and possible to detect even during the hospital phase it may be a target for novel secondary preventive efforts (5). The global prevalence of *diabetes mellitus* has continuously and rapidly increased. The prevalence of and mortality from all forms of cardiovascular diseases is two- to eight-fold higher in diabetic individuals as compared with their non-diabetic counterparts (6).

The aim of the study was to assess the prevalence of hyperglycemia and type 2 diabetes in incidental acute coronary syndrome.

MATERIAL AND METHODS

The whole studied group covered 124 (44 F; 80 M) subjects with acute coronary syndrome including 30 diabetics and 94 non-diabetic patients aged 38–90 (mean 64.0±10.4y) hospitalized in Intensive Coronary Care Unit of Cardiology (ICCU) Department Medical University in Lublin. In the time of admission into ICCU glucose level and the next morning fasting blood glucose in every patient in the venous blood has been measured. Diabetes and abnormal glucose tolerance was diagnosed according PDA 2006 recommendations (7). Based on ABG level patients were divided in 5 groups: group 1 – ABG <100 mg/dl, group 2 – ABG between 101–120 mg/dl: group 3 – ABG between 121–140 mg/dl; group 4 – ABG between 141–160 mg/dl, and group 5 ABG over 160 mg/dl. The clinical characteristics of the studied group is presented in Table 1.

RESULTS

The obtained results are illustrated in Table 1. The subjects with previously diagnosed diabetes constituted 24% of whole group. In this group the number of women was somewhat lower than that

of men whereas the mean age was the highest of the studied groups as well as higher than mean value for the whole group of non-diabetic patients. The mean admission blood glucose for diabetics was significantly higher than that of non-diabetic patients. Men composed a majority in the whole group of ACS patients without an earlier diagnosed *diabetes mellitus* and in subgroups with ABG till 160 mg/dl (M: F= 2:1). Women were more numerous just in the group with the highest values of admission glucose (160 mg/dl). Merely in 20% of non-diabetic patients, characterized by the lowest mean age, the admission blood glucose value exceeding 100 mg/dl has been found. The most often occurred admission blood glucose value was contained at interval between 101–120 mg/dl. It has been found in nearly 30% of ACS patients.

In two subjects out of all patients with the admission blood glucose as much as 120 mg/dl hitherto latent *diabetes mellitus* has been diagnosed. With ABG values of more than >120 mg/dl, the number of subjects with existing latent *diabetes mellitus* has markedly increased and reached the highest frequency in the ABG group with values increased more than >160 mg/dl. Finally, in the whole studied group of patients with acute coronary syndrome, recently recognized diabetes mellitus has been ascertained in 11 subjects (11.7%).

Including the subjects with newly diagnosed diabetes, patients with the advanced carbohydrate disorders constituted 33% of our all hospitalized ACS patients.

Table 1. Clinical characteristics, levels of admission glucose and frequency of recently diagnosed type 2 diabetes in studied groups of patients

Groups / Parameter	Patients with previously diagnosed diabetes	Non-diabetic patients					
		whole group	group 1 <100 mg/dl	group 2 101-120 mg/dl	group 3 121-140 mg/dl	group 4 141-160 mg/dl	group 5 >160 mg/dl
Number of pts (%)	30	94 (100%)	19 (20.2%)	27 (28.7%)	17 (18.1%)	15 (15.9%)	16 (17%)
Gender	F13; M17	E31; M63	F6; M13	F8:M19	F5; M12	F3;M12	F9;M7
Age (years) X±SD (range)	66.5 ± 8.1 (51–80)	63.2 ± 10.9 (38–90)	59.6 ± 8.0 (47–75)	61.7 ± 12.6 (38–85)	68.2 ± 10.8 (46–90)	64.5 ± 10.8 (49–82)	63.4 ± 10.4 (49–82)
ABG mg /dl X±SD (range)	188 ± 110.5 (58–509)	134.1 ± 48.7 (71–446)	91 ± 8.9 (71–100)	110.2 ± 5.9 (101–120)	130.2 ± 5.2 (121–137)	152.1 ± 5.7 (141–160)	208.3 ± 68.4 (164–446)
Recently diagnosed t. 2 diabetes	(-)	11 (F4; M7)	1	1	3	2	4

DISCUSSION

The risk for major complications after an incident myocardial infarction was closely related to admission blood glucose concentrations near to or within the normal range, and certainly below the diabetic threshold. A lot of study showed that admission plasma glucose concentration was predictor of survival after acute myocardial infarction independently of sex, age and previous heart failure (1–5, 12). Thus, admission hyperglycemia still provides an early marker of bad prognosis after an acute myocardial infarction in an era of modern therapy and stratified patients with acute coronary syndromes according to their risk of in-hospital left ventricular failure and cardiac mortality (3–5). There was no detectable glycemic threshold for these adverse effects. The prognostic correlates of admission glycemia were unaffected by diabetic status, independent of glycemia reason and did not differ significantly between patients with acute myocardial infarction and those with unstable angina

(3, 8). Therefore, screening for diabetes and hyperglycemia is recommended in various clinical settings. Criteria for classification of hyperglycemic states are provided together with their relation to risk for cardiovascular events (6).

The results of our studies confirm considerable frequency of hyperglycemia in hospitalized ACS patients. Just every fifth patent treated in ICCU has revealed the admission glucose values which did not exceed the range of norm.

Recent data revealed that patients with myocardial infarction have a high prevalence of previously unknown diabetes mellitus and impaired glucose tolerance (5, 9, 10–13).

In our study, the patients with previously diagnosed *diabetes mellitus* constituted nearly ¼ of hospitalized ACS subjects, similarly as in the other reports (10, 11). Moreover, in one out of every 10 ACS patients, *diabetes mellitus* has been diagnosed just at the admission to ICCU which increased the frequency of diabetes occurrence to 1/3 of the whole group.

Elevated admission glucose appears more important than prior long-term abnormal glucose metabolism in predicting mortality in patients with ACS (14, 15). Acute rather than the chronic glycometabolic disturbances account for the prognosis in acute coronary syndrome. Admission hyperglycemia in patients with acute coronary syndrome may be a stronger risk factor than previous diabetes (2, 16).

Wallander and colleagues (16) stressed that admission hyperglycemia in non-diabetic patients with ACS represent previously undiagnosed abnormal glucose tolerance. To a significant extent, this seems to be related to impaired beta cell function, implies that dysglycemia immediately after an infarction is rarely a stress epiphenomenon but frequently reflects stable disturbances of glucose regulation preceding acute coronary syndrome. This opinion has been confirmed by the observed increased number of patients with newly diagnosed diabetes in subjects with increasing values of admission glucose.

The current epidemic of obesity, metabolic syndrome and *diabetes mellitus* warrants aggressive screening of carbohydrate disturbances in patients with acute coronary syndrome. High admission blood glucose level in ACS patients may serve as marker to identify subjects at high long-term mortality risk, in particular among those with unknown diabetes.

A lot of studies showed that admission plasma glucose concentration was predictor of survival after acute myocardial infarction independently of sex, age and previous heart failure (1–5, 12). Therefore, screening for diabetes and hyperglycemia is recommended in various clinical settings. Criteria for classification of hyperglycemic states are provided together with their relation to risk for cardiovascular events (6).

REFERENCES

1. Capes S. E., Hunt D. et al.: Stress hyperglycaemia and increased risk of death after myocardial infarction in patients with and without diabetes: a systematic overview. Lancet, 355, 773, 2000.
2. Hadjadj S., Coisne D. et al.: Prognostic value of admission plasma glucose and HbA in acute myocardial infarction. Diabet. Med., 21, 305, 2004.
3. Foo K., Cooper J. et al.: A single serum glucose measurement predicts adverse outcomes across the whole range of acute coronary syndromes. Heart, 89, 512, 2003.
4. Meisinger C., Hormann A. et al.: Admission blood glucose and adverse outcomes in non-diabetic patients with myocardial infarction in the reperfusion era. Int. J. Cardiol., 113, 229, 2006.
5. Bartnik M., Malmberg K. et al.: Newly detected abnormal glucose tolerance: an important predictor of long-term outcome after myocardial infarction. Eur. Heart J., 25, 1990, 2004.

6. Bartnik M., Malmberg K. et al.: Recognising and treating the diabetic patient in cardiovascular care. Eur. J. Cardiovasc. Nurs., 1, 171, 2002.
7. Zalecenia kliniczne dotyczące postępowania u chorych na cukrzycę, 2006. Stanowisko Polskiego Towarzystwa Diabetologicznego. Diabetologia Praktyczna, 7, supl. A, A1, 2006.
8. Nelson C., Lange T. et al.: Blood glucose and coronary artery disease in nondiabetic patients. Diabetes Care, 29, 998, 2006.
9. Ishihara M., Inoue I. et al.: Is admission hyperglycaemia in non-diabetic patients with acute myocardial infarction a surrogate for previously undiagnosed abnormal glucose tolerance? Eur. Heart J., 27, 2413, 2006.
10. Bartnik M., Ryden L. et al.: and Euro Heart Survey Investigators. The prevalence of abnormal glucose regulation in patients with coronary artery disease across Europe. The Euro Heart Survey on diabetes and the heart. Eur. Heart J., 25, 1880, 2004.
11. Conaway D. G., O'Keefe J. H.: Frequency of undiagnosed and untreated *diabetes mellitus* in patients with acute coronary syndromes. Expert Rev. Cardiovasc. Ther., 4, 503, 2006.
12. Standers I., Diamant M. et al.: Admission blood glucose level as risk indicator of death after myocardial infarction in patients with and without *diabetes mellitus*. Arch. Intern. Med., 164, 982, 2004.
13. Norhammar A., Tenerz A. et al.: Glucose metabolism in patients with acute myocardial infarction and no previous diagnosis of *diabetes mellitus*: a prospective study. Lancet, 359, 2140, 2002.
14. Tenerz A., Lonnberg I. et al.: Myocardial infarction and prevalence of *diabetes mellitus*. Is increased casual blood glucose at admission a reliable criterion for the diagnosis of diabetes? Eur. Heart J., 22, 1102, 2001.
15. Timmer J. R., Ottervanger J. P. et al.: Prognostic value of admission glucose and glycosylated haemoglobin levels in acute coronary syndromes. QJM, 99, 237, 2006.
16. Wallander M., Bartnik M. et al.: Beta cell dysfunction in patients with acute myocardial infarction but without previously known type 2 diabetes: a report from the GAMI study. Diabetologia, 48, 2229, 2005.

SUMMARY

Higher blood glucose may increase risk of death and poor outcome after acute myocardial infarction. Diabetics with ACS constitute a group of patients with a especially poor prognosis. The aim of the study was to assess the prevalence of hyperglycemia and type 2 diabetes in incidental acute coronary syndrome (ACS). 124 (44 F; 80 M) subjects with acute coronary syndrome including 30 diabetics and 94 non-diabetic patients aged 38–90 y (mean 64.0±10.4y). After admission to the intensive care unit blood glucose level of every patient has been measured. Diabetes and abnormal glucose tolerance were diagnosed according PDA 2006 recommendations. Mean admission glucose level in diabetic patients group was 188±110.5 mg% (range 58–509) whereas in non-diabetic patients 134.1±48.7 mg% (71–446). Merely in 19 (20.2%) non-diabetics with ACS admission glucose level did not exceed 100 mg%. In the other patients without previously diagnosed diabetes: in 27 (28.7%) subjects randomly measured glycemia at admission ranged from 101 to120 mg% (mean 110.2± 5.9); in 17 (18.1%) patients – between 120–140 mg% (mean 130.2± 5.2 mg%); in 15 (15.9%) subjects between 140–160 mg% (mean 152.1±5.7); in 16 (17%) above 160 mg% (mean 208.3±68.6). Recently diagnosed diabetes type 2 has been ascertained in 11 (11.7%) subjects. In the whole studied group of patients with ACS frequency of diabetes type 2 figured out 33.1% (41/124 patients). Patients with acute coronary syndrome showed a high prevalence of type 2 diabetes and hyperglycemia following ACS.

Zwiększona częstość hiperglikemii i cukrzycy typu 2 u osób z ostrym zespołem wieńcowym (ACS)

Podwyższona glikemia w momencie hospitalizacji z powodu ostrego zawału serca jest czynnikiem ryzyka zwiększonej śmiertelności i pogarsza rokowanie zarówno u pacjentów z cukrzycą, jak i u osób bez wcześniej rozpoznawanych zaburzeń węglowodanowych. Chorzy z ostrym zespołem wieńcowym i cukrzycą stanowią grupę osób ze szczególnie niekorzystnym rokowaniem. Zbadano 124 (44 K; 80 M) pacjentów z ACS, w tym 30 chorych na cukrzycę oraz 94 osoby bez wcześniej rozpoznawanych zaburzeń węglowodanowych; wiek 38–90 lat (śr 64,0±10,4). U każdego chorego oznaczano glikemię w momencie hospitalizacji w OIOK. Zaburzenia tolerancji glukozy oraz cukrzyca były diagnozowane zgodnie z rekomendacjami PDA 2006. Średnia wartość glikemii w momencie hospitalizacji wynosiła u chorych na cukrzycę 188±110,5 mg% (58–509); w grupie bez cukrzycy 134,1±48,7 mg% (71–446). Tylko u 19 (20%) osób z ACS bez rozpoznawanej wcześniej cukrzycy glikemia w momencie hospitalizacji nie przekraczała 100 mg%. U pozostałych osób bez wcześniej rozpoznawanej cukrzycy glikemia w momencie hospitalizacji wynosiła: u 27 (28,7%) badanych między 101 a 120 mg% (średnio 110,2± 5,9); u 17(18,1%) – między 120 a 140 (średnio 130,2± 5,2) mg%; u 15 (15,9%) między 140 a 160 (średnio 152,1±5,7) mg%; u 16 (17%) >160 mg% (średnio 208,3±68,6). Dotychczas nieznaną cukrzycę typu 2 rozpoznano u 11 (11,7%) osób. W całej ocenianej grupie chorych z ACS częstość cukrzycy typu 2 wynosiła 33,1% (41/124). Wśród chorych z ostrymi zespołami wieńcowymi stwierdza się znaczną częstość występowania hiperglikemii oraz cukrzycy typu 2.