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THE EFFECT OF BLOOD PRESSURE WITHIN THE RANGE OF «130/80 – 139/89 MM HG» ON THE MAGNITUDE OF CARDIOVASCULAR RISK IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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The outpatient records of 596 patients in the archives of the Azerbaijan Association of Endocrinology, Diabetology and Therapeutic Training were analyzed. A group with DM2 (n=450) was identified. To determine the effect of the blood pressure level on the value of CVR, the group participants were divided into 3 subgroups: 1) a subgroup of "Ideal Normotension" (n=71), which included people with blood pressure within the normal range according to both ESC/ESH (2018) and ACC/AHA (2017) criteria; 2) a subgroup of "Ideal Hypertension" (n=125), which included people with hypertension according to both ESC/ESH (2018) and ACC/AHA (2017) criteria; 3) a subgroup of "Intermediate BP" (n=254), which included people with hypertension according to ACC/AHA criteria (2017) and "high norm" according to ESC/ESH criteria (2018).

To determine the CVR, the following methods were used: PROCAM risk score; Framigham risk score based on lipid profile; Framigham risk score based on body mass index; QRISK 2 risk score; Pooled Cohort Equations risk score; ASCVD risk score.

The average values of the CVR level in the "Ideal Normotension" subgroup of the DM2 group were 8.5% (95% CI. 7.80; 9.28). In the "Intermediate BP" subgroup, this indicator corresponded to 12.9% (95% CI.12.32; 13.51), and in the subgroup of "Ideal hypertension" the value of cardiovascular risk was 18.0% (95% CI 17.43; 18.55). The differences between all subgroups were statistically highly significant p<0.001.

The use of CVR calculators both individually and in combination in patients in the DM2 group indicate that an increase in SBP to 130-139 mmHg and/or DBP to 80-89 mmHg contributed to an increase in cardiovascular risk. It can be assumed that a further increase in blood pressure further increases this risk.

Key words: *arterial hypertension, type 2 diabetes mellitus, ESC/ESH criteria (2018), ACC/AHA criteria (2017).*

Connection of the publication with planned research works.

This work is a fragment of a dissertation for the degree of Doctor of Philosophy in medicine.

Introduction.

Arterial hypertension (AH) is a powerful risk factor for the development of cardiovascular diseases (CVD) and also diabetes mellitus (DM) [1, 2]. 80% of diabetic patients die from CVD, in particular, from myocardial infarction and stroke. The coexistence of hypertension with diabetes leads to an increase in the risk of death and cardiovascular events (CVE) by 44% and 41%, respectively, compared with 7% and 9% risks in people suffering only from diabetes and not suffering from hypertension [1, 2]. There is evidence that AH treatment and blood pressure (BP) control significantly reduce the risk of CVE and cerebrovascular events, as well as morbidity and mortality in patients with diabetes [3, 4, 5]. It is also assumed that antihypertensive treatment improves endothelial function, reduces sympathetic activity, demonstrating significant anti-atherosclerotic and antifibrotic effects [6, 7, 8, 9, 10].

To solve this issue, we can apply the value of cardiovascular risk (CVR), which can prove whether the CVR changes in patients with type 2 diabetes mellitus (DM2) with an increase in BP in the range of 130/80 – 139/89 mmHg.

The aim of the study.

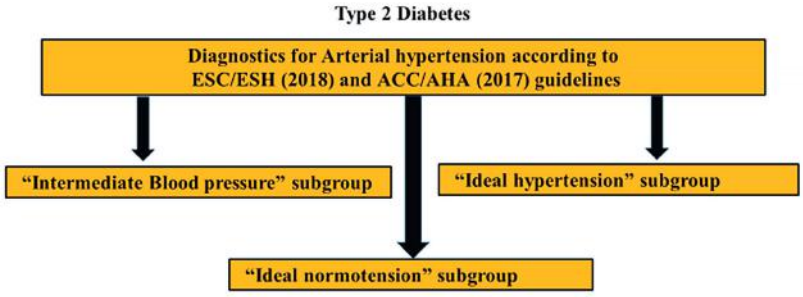

Figure 1 – Subgroups based on criteria for the diagnosis of hypertension according to ESC/ESH (2018) and ACC/AHA (2017) in DM2.

To determine the effect of blood pressure within the range of "130/80 – 139/89 mmHg" on the magnitude of cardiovascular risk in patients with type 2 diabetes mellitus.

Object and methods of research.

The outpatient records of 596 patients in the archives of the Azerbaijan Association of Endocrinology, Diabetology and Therapeutic Training were analyzed.

A group with DM2 was identified (n=450) and to determine the effect of BP on the value of CVR, the group participants were divided into 3 subgroups:

• A subgroup of "Ideal normotension" (n=71), which included people with BP within the normal range according to both ESC/ESH (2018) criteria [3] and ACC/AHA (2017) criteria [2];

• A subgroup of "Ideal hypertension" (n=125), which included people with AH according to both ESC/ESH (2018) criteria [3] and ACC/AHA (2017) criteria [2];

• A subgroup of "Intermediate BP" (n=254), which included people with AH according to ACC/AHA criteria (2017) [2] and "high norm" according to ESC/ESH criteria (2018) [3] **(fig. 1)**.

The criteria for inclusion in the study of patients were the presence in their outpatient records of the following data: surname and name of the attending physician; date of initial examination; gender of the patient; age of the patient; height; body weight; BP values; information about the presence of DM and/or taking hypoglycemic drugs in the anamnesis; the results of the study of glycohemoglobin (A1c); fasting glycemia; lipidogram values (total cholesterol (TC), high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL cholesterol), triglycerides (TG)), as well as the glomerular filtration rate (GFR) of 60 ml/min / 1.73 m^2 or more.

The criteria for exclusion from the study were: the presence of type 1 diabetes mellitus or other (specific) types C; pregnancy; pronounced independent or comorbid endocrine pathology, which can significantly affect both the level of A1c and other indicators of metabolism and blood pressure; pronounced comorbid pathology on the part of internal organs, which can significantly affect both the state of carbohydrate metabolism metabolism, and the state of blood pressure.

The basis for inclusion of patients with DM2 was anamnestic information about the presence of DM2 and / or taking hypoglycemic drugs. In case of their absence, the criterion for inclusion in group C 2 was the presence of at least three diagnostic indicators [11, 12, 13, 14]:

• A1c level with 6.5% (48 mmol/mol) and above;

• Fasting venous plasma glycemia 126 mg/dl (7.0 mmol/L) and above;

• glycemia in venous plasma 2 hours after a load of 75.0 g of glucose 200 mg/dl (11.1 mmol/l) and higher.

To determine CVR, the following methods were used:

• PROCAM risk score [11];

• Framigham risk score с учетом профиля липидов [12];

• Framigham risk score с учетом индекса массы тела [12];

• QRISK 2 risk score [13];

• Pooled Cohort Equations risk score [14, 15];

• ASCVD risk score [16, 17].

The statistical analysis was carried out using a standard Microsoft Excel computer program [18]. During the statistical analysis of the material, the average sample sizes, the values of the fractions (%) were determined. The confidence interval of the fractions was determined for a 95% probability using the Wilson method using an online calculator [19]. The confidence interval of the averages was also determined for a 95% probability. Calculations were performed using Confidence Limits for Mean Calculator [20]. The significance of the differences between the

Table – Average values of CVR in the group of patients with DM2, divided into Subgroups

AVCVR (%)*/95% CI	Groups			P		
	The subgroup of «Ideal normotension»	The «Intermediate BP» subgroup	The subgroup of «Ideal hypertension»	1-2	1-3	2-3
The method of determining the value of CVR: PROCAM risk score [11]						
AVCVR (%)	7.2	12.1	16.1	<0.001	<0.001	<0.01
95% CI	5.41; 8.95	10.38; 13.73	14.65; 17.54			
The method of determining the value of CVR: Framingham risk score based on lipid profile [12]						
AVCVR (%)	10.7	16.5	23.0	<0.01	<0.001	<0.01
95% CI	8.69; 2.75	14.97; 17.95	21.65; 24.41			
The method of determining the value of CVR: Framingham risk score based on body mass index [12]						
AVCVR	12.1	26.5	17.4	<0.05	<0.001	<0.001
95% CI	10.30; 13.88	25.26; 27.76	16.14; 18.71			
The method of determining the value of CVR: QRISK 2 risk score [13]						
AVCVR (%)	9.2	13.4	17.2	<0.01	<0.001	<0.05
95% CI	7.54; 10.91	12.22; 4.67	16.13; 18.25			
The method of determining the value of CVR: Pooled Cohort Equations risk score [14-15]						
AVCVR (%)	6.0	9.1	12.6	<0.01	<0.001	<0.01
95% CI	4.46; 7.57	7.90; 10.20	11.50; 13.63			
The method of determining the value of CVR: ASCVD risk score [16-17]						
AVCVR (%)	6.0	9.1	12.6	<0.01	<0.001	<0.01
95% CI	4.46; 7.58	7.90; 10.21	11.50; 13.63			

Note: AVCVR – the average value of cardiovascular risk.

fractions was calculated using the χ2 method [21].

Research results and their discussion.

Table shows data on the average values of CVR in the group of patients with DM2, divided into Subgroups of "Ideal normotension" (n=71), "Ideal hypertension" (n=125), "Intermediate BP" (n=254).

The average value of the CVR in the Subgroup of "Ideal normotension" was in the range of 6.0% (95% CI. 4.46; 7.58) when determined by ASCVD risk score [16, 17] up to 12.1% (95% CI.10.30; 13.88) when determined by Framigham risk score taking into account body mass index [2].

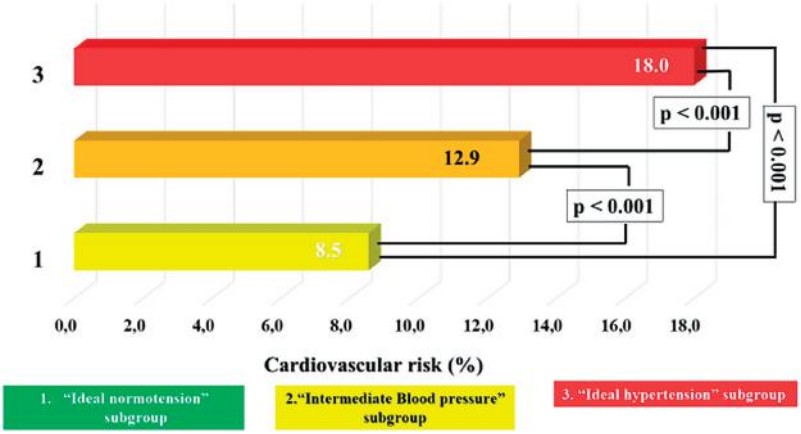

Figure 2 – The average values of CVR levels for the subgroups of "Ideal normotension", "Intermediate BP" and "Ideal hypertension" of the DM2 subgroup, while taking into account the data of all risk calculators used in the study.

In the "Intermediate BP" subgroup, the average value of the CVR was minimum – 9.1% when determined by ASCVD risk score [16, 17] (95% CI. 7.90; 10.21) and Pooled Cohort Equations risk score [14, 15] (95% CI. 7.90; 10.20), and maximum – when determining according to the Framigham risk score, taking into account the body mass index [2] – 26.5% (95% CI. 25.26; 27.76). In the subgroup of "Ideal hypertension", the average value of CVR ranged from 12.6% (95% CI. 11.50; 13.63) to 17.4% (95% CI. 16.14; 18.71).

The differences between the "Ideal Normotension" subgroup and the "Intermediate BP" subgroup were statistically significant in all cases: from a minimum p<0.01 when using Pooled Cohort Equations risk score (6.0% vs 9.1%) to a maximum p<0.01 when using Framigham risk score, taking into account the lipid profile [2] (10.7% vs 16.5%) and p<0.05 when using Framigham risk score taking into account body mass index [2] (12.1% vs 26.5%). The differences between the subgroup of "Ideal normotension" and the subgroup of "Ideal hypertension" were statistically significant in all cases (p<0.001). The differences between the "Intermediate level" subgroup and the "Ideal hypotension" subgroup were statistical values: when comparing the Framigham risk assessment, taking into account the amount of lipids [2]:16.5 vs. 23.0, CVD risk assessment [16, 17]: 9.1% vs. 12.6%, PROCAM risk assessment [11]: 12.1 vs. 16.1% in total, the risk assessment according to cohort equations [14,15]: 9.1% vs. 12.6%, p<0.01; risk assessment according to the QRISK 2 criterion [13]: 13.4 vs. 17.2%, p<0.05. The differences were statistically significant when assessing the Framingham risk index taking into account body mass index [2]: 26.5 versus 17.4%, p<0.001.

Figure 2 shows data on the average values of CVR levels for the subgroups of "Ideal normotension", "Intermediate BP" and "Ideal hypertension" while taking into account the data of all the above-listed CVR calculators.

As can be seen from **fig. 2**, the average values of the CVR level in the subgroup of the "Ideal normotension" group of DM2 were 8.5% (95% CI. 7.80; 9.28). In the subgroup of the "Intermediate BP", this indicator corresponded to 12.9% (95% CI.12.32; 13.51), and in the subgroup of "Ideal hypertension" the value of cardiovascular risk was 18.0% (95% CI 17.43; 18.55). The differences between all subgroups were statistically highly significant: p<0.001.

Conclusions.

The use of CVR calculators both individually and in combination in patients in the DM2 group indicates that an increase in SBP to 130-139 mmHg and/or DBP to 80-89 mmHg contributed to an increase in cardiovascular risk. It can be assumed that a further increase in blood pressure further increases this risk.

Prospects for further research.

Development of methods to reduce the effect of blood pressure on the magnitude of cardiovascular risk in patients with diabetes mellitus.

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ВПЛИВ АРТЕРІАЛЬНОГО ТИСКУ У МЕЖАХ «130/80 – 139/89 ММ РТ. СТ.» НА РІВЕНЬ СЕРЦЕВО-СУДИННОГО РИЗИКУ У ХВОРИХ НА ЦУКРОВИЙ ДІАБЕТ 2 ТИПУ

Іскандер М. А.

Резюме. *Мета дослідження* полягала у визначення впливі артеріального тиску «130/80 – 139/89 мм рт.ст.» на рівень серцево-судинного ризику у хворих на цукровий діабет 2 типу (ЦД 2 типу).

Об'єкт і методи дослідження. Проаналізовано амбулаторні карти 596 пацієнтів з архіву Азербайджанської Асоціації Ендокринології, Діабетології та Терапевтичного Навчання. Було виділено групу з ЦД 2 типу (n=450). З метою визначення впливу рівня АТ на рівень ССР учасників дослідження було розділено на 3 підгрупи:

1) підгрупа «Ідеальної нормотензії» (n=71), до якої віднесли пацієнтів з АТ у межах норми як за критеріями ESC/ESH (2018), так і за критеріями ACC/AHA (2017);

2) підгрупу «Ідеальної гіпертензії» (n=125), до якої віднесли пацієнтів з АГ як за критеріями ESC/ESH (2018), так і за критеріями ACC/AHA (2017);

3) підгрупу «Проміжного АТ» (n=254), до якої віднесли пацієнтів з АГ за критеріями ACC/AHA (2017) та «високої норми» за критеріями ESC/ESH (2018).

З метою визначення ССР було використано: PROCAM risk score; Framigham risk score з урахуванням ліпідного профілю; Framigham risk score з урахуванням індексу маси тіла; QRISK 2 risk score; Pooled Cohort Equations risk score; ASCVD risk score.

Результати. Середні показники рівня ССР у підгрупі «Ідеальної нормотензії» групи ЦД 2 типу становили 8.5% (95% CI. 7.80; 9.28). У підгрупі «Проміжного АТ» цей показник складав 12.9% (95% CI.12.32; 13.51), а у підгрупі «Ідеальної гіпертензії» рівень серцево-судинного ризику складав 18.0% (95% CI 17.43; 18.55). Різниця між підгрупами була статистично високо значимою p<0.001.

Висновки. Застосування калькуляторів ССР як окремо, так і в комплексі у пацієнтів у групі ЦД 2 типу показують, що підвищення САТ до 130-139 мм рт.ст. і/або ДАТ до 80-89 мм рт.ст. сприяло підвищенню серцево-судинного ризику. Можливо передбачити, що подальше підвищення АТ ще більше підвищить цей ризик.

Ключові слова: артеріально гіпертензія, цукровий діабет 2 типу, критерії ESC/ESH (2018), критерії ACC/AHA (2017).

THE EFFECT OF BLOOD PRESSURE WITHIN THE RANGE OF «130/80 – 139/89 MM HG» ON THE MAGNITUDE OF CARDIOVASCULAR RISK IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

Isgandar M. A.

Abstract. *The aim of the study* was to determine the effect of blood pressure within the range of "130/80 – 139/89 mmHg" on the value of cardiovascular risk in patients with type 2 diabetes mellitus.

Object and methods of research. The outpatient records of 596 patients in the archives of the Azerbaijan Association of Endocrinology, Diabetology and Therapeutic Training were analyzed. A group with DM2 (n=450) was identified. To determine the effect of the blood pressure level on the value of CVR, the group participants were divided into 3 subgroups:

1) a subgroup of "Ideal Normotension" (n=71), which included people with blood pressure within the normal range according to both ESC/ESH (2018) and ACC/AHA (2017) criteria;

2) a subgroup of “Ideal Hypertension” (n=125), which included people with hypertension according to both ESC/ESH (2018) and ACC/AHA (2017) criteria;

3) a subgroup of “Intermediate BP” (n=254), which included people with hypertension according to ACC/AHA criteria (2017) and “high norm” according to ESC/ESH criteria (2018).

To determine the CVR, the following methods were used: PROCAM risk score; Framigham risk score based on lipid profile; Framigham risk score based on body mass index; QRISK 2 risk score; Pooled Cohort Equations risk score; ASCVD risk score.

Results. The average values of the CVR level in the “Ideal Normotension” subgroup of the DM2 group were 8.5% (95% CI. 7.80; 9.28). In the “Intermediate BP” subgroup, this indicator corresponded to 12.9% (95% CI.12.32; 13.51), and in the subgroup of “Ideal hypertension” the value of cardiovascular risk was 18.0% (95% CI 17.43; 18.55). The differences between all subgroups were statistically highly significant: p <0.001.

Conclusions. The use of CVR calculators both individually and in combination in patients in the DM2 group indicate that an increase in SBP to 130-139 mmHg and/or DBP to 80-89 mmHg contributed to an increase in cardiovascular risk. It can be assumed that a further increase in blood pressure further increases this risk.

Key words: Arterial hypertension, type 2 diabetes mellitus, ESC/ESH criteria (2018), ACC/AHA criteria (2017).

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EXPERIENCE OF ANAESTHETIC MANAGEMENT AND INTENSIVE CARE IN PATIENTS WITH SINGLE VENTRICLE PHYSIOLOGY

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Single ventricle physiology is a term used to describe a group of complex congenital heart defects with a single functioning ventricle. The survival of such patients depends on mixing systemic deoxygenated blood with oxygenated pulmonary venous blood and on an open channel for redirecting the mixed blood to the small and systemic circulation. Palliative treatment of patients with single ventricle physiology aims to transfer the single ventricle circulation from parallel to sequential and includes three stages, culminating in total Fontan cavopulmonary anastomosis. Bidirectional cavopulmonary anastomosis is the second stage of haemodynamic correction in patients with single ventricle physiology. It eliminates parallel circulation and ventricular volume overload but not cyanosis. The study aims to describe the experience of anaesthetic management and intensive care in patients with single ventricle physiology at the stage of haemodynamic correction. From 1996 to 2022, 104 patients with a single ventricle underwent bidirectional cavopulmonary anastomosis at the Amosov National Institute of Cardiovascular Surgery of the National Academy of Medical Sciences of Ukraine. The main methods used to determine the defect and assess postoperative outcomes were cardiac cavity sounding and echocardiography. All patients were divided into two age groups. Group A included 57 patients (55%) aged 3 to 36 months, and Group B consisted of 47 patients (45%) over 36 months. There is a lower need for prolonged intensive care, a lower number and less severe severity of postoperative complications, a longer overall ICU stay, and a higher average systemic saturation in patients who were operated on between the ages of 3 and 36 months due to the peculiarities of haemodynamic and adaptive processes. The choice of age and tactics for hemodynamic correction in patients with single ventricle physiology directly affects the perioperative period and the results of palliative treatment.

Key words: *congenital heart disease, single ventricle, haemodynamic correction, blood circulation, anastomosis.*

Connection of the publication with planned research works.

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Introduction.

Congenital heart disease is one of the most common congenital malformations. The incidence of congenital heart disease, according to various sources, ranges from 7 to 9 per 1000 live births. Pathologies with a single ven-