THE ROLE OF DIABETES IN THE DEVELOPMENT OF PERIPHERAL ARTERY DISEASES AND RECENT WAYS OF REVISCULARIZATION OF LOWER LIMB ARTERIES (REVIEW)

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Zhakubayev M.A.[1,2], Egemberdiev T.Zh.[2], Matkerimov A.Zh.[1], Baubekov A.A.[1,2], Tergeusizov A.S.[1], Tajibayev TK.[1], Shamshiev A.S.[1], Saduakas A.E.[1], Makkamov R.O.[1], Nurmaganbet S.T.[1], Sharifova B.K.[1]
[1]JSC "National scientific center of surgery named after A.N. Syzganov", Almaty, Kazakhstan
[2]JSC "National medical university", Almaty, Kazakhstan

Abstract

Diabetes is one of the priority diseases in the health care system of all countries of the world, due to the high prevalence of this pathology in the population and the increase in socio-economic losses associated with the development of severe disabling complications. Every year, more than 1 million operations of amputation of the lower extremities in diabetes are performed in the world, more than 600 thousand patients lose their sight, and approximately 500 thousand patients develop renal failure. Over 50% of all non-traumatic amputations are accounted for by diabetics. The article provides a literature review, covering foreign and domestic data. The review is devoted to modern approaches to various types of diagnostics and treatment of peripheral artery diseases caused by diabetes, comparative studies, as well as prevention methods.

ABOUT THE AUTHORS
Zhakubayev M.A. *- angiosurgeon, PhD doctoral student of KazNMU named after S.D. Asfendiyarov, a vascular surgeon of the Department of Angiosurgery of the JSC NSCS named after A.N. Syzganov;*
Yegemberdiyev T.Zh. *- professor, MD, the head of the cardiovascular surgery department of surgical diseases № 3 KazNMU named after S.D. Asfendiyarov;*
Baubekov A.A. *- Phd doctoral student of KazNMU named after. S.D. Asfendiyarov, a vascular surgeon of the Department of Angiosurgery of the JSC NSCS named after A.N. Syzganov;*
Matkherimov A.Zh. *- Head of the Department of Angiosurgery of the JSC NSCS named after A.N. Syzganov;*
Tergeusizov A.S. *- angiosurgeon of the JSC NSCS named after A.N. Syzganov;*
Tadjibaev T.K. *- angiosurgeon of the JSC NSCS named after A.N. Syzganov.*
Shamshiev A.S. *- angiosurgeon of the JSC NSCS named after A.N. Syzganov;*
Saduakas A.E. *– resident angiosurgeon of the JSC NSCS named after A.N. Syzganov;*
Makkamov R.O. *– resident angiosurgeon of the JSC NSCS named after A.N. Syzganov;*
Nurmahanbet S.T. *– resident angiosurgeon of the JSC NSCS named after A.N. Syzganov;*
Sharifova B.K. *– resident angiosurgeon of the JSC NSCS named after A.N. Syzganov.*

Keywords
diabetes, peripheral artery diseases, amputation.

Қант диабетінің перифериалық артериялардың ауруларының дамуындағы рөлі және аяқ артерияларын реваскуляризациялаудың заманауи әдістері (әдеби шолу)

Жакубаев М.А.[1,2], Егембердиев Т.Ж.[2], Маткеримов А.Ж.[1], Баубеков А.А.[1,2], Тергеусизов А.С.[1], Таджибаев Т.К.[1], Шамшиев А.С.[1], Садуакас А.Е.[1], Маккамов Р.О.[1], Нурмаганбет С.Т.[1], Шарифова Б.К.[1]
[1]«А.Н.Сызғанов атындағы Ұлттық ғылыми хирургия орталығы» АҚ, Алматы, Қазақстан
[2]«Ұлттық медицина университеті» АҚ, Алматы, Қазақстан

Аңдатпа

Қант диабеті - халықтың осы патологиясының жоғары таралуы және ауыр бұзылуға әкелетін асқынулардың дамуымен байланысты әлеуметтік-экономикалық шығындардың өсуіне байланысты әлемнің барлық елдерінің денсаулық сақтау жүйесіндегі басым аурулардың бірі. Жыл сайын әлемде қант диабетіне байланысты төменгі аяқтардың ампутациясы 1 миллионнан астам операция жасалады, 600 мыңнан астам пациент өз көзқарасын жоғалтады, ал 500 мыңға жуық пациент бүйрек жетіспеушілігін дамытады. Травматикалық емес ампутацияның 50% -дан астам диабетпен ауратын науқастарда тіркелген. Мақалада шетелдік және отандық деректерді қамтитын әдеби шолу қарастырылған. Шолу пациенттердің қант диабеті, салыстырмалы зерттеулер, сондай-ақ алдын алу әдістерімен туындаған шеткері артерия ауруларын диагностикалаудың және емдеудің заманауи тәсілдеріне арналған.

АВТОРЛАР ТУРАЛЫ
Жакубаев М.А. *– С.Д. Асфендияров атындағы ҚазҰМУ Phd докторанты, А.Н. Сызғанов атындағы ҰҒХО АҚ қан-тамырлар бөлімшесінің ангиохирургы;*
Егембердиев Т.Ж. *- профессор, м.ғ.д., С.Д. Асфендияров атындағы ҚазҰМУ №3 хирургиялық аурулар кафедрасының жүрек-қан тамырлары хирургиясы курсының меңгерушісі;*
Маткеримов А.Ж. *– А.Н. Сызганов атындағы ҰҒХО АҚ қан-тамырлар бөлімшесінің меңгерушісі;*
Баубеков А.А. *- С.Д. Асфендияров атындағы ҚазҰМУ Phd докторанты, А.Н. Сызганов атындағы ҰҒХО АҚ қан-тамырлар бөлімшесінің ангиохирургы;*
Тергеусизов А.С. *- А.Н. Сызганов атындағы ҰҒХО АҚ қан-тамырлар бөлімшесінің дәрігер- ангиохирургі;*
Таджибаев Т.К. *– А.Н. Сызганов атындағы ҰҒХО АҚ қан-тамырлар бөлімшесінің дәрігер- ангиохирургі.*
Шамшиев А.С. *– А.Н. Сызганов атындағы ҰҒХО АҚ қан-тамырлар бөлімшесінің дәрігер- ангиохирургі;*
Садуакас А.Е. *– А.Н. Сызганов атындағы ҰҒХО АҚ резидент - ангиохирургі.*
Маккамов Р.О *– А.Н. Сызганов атындағы ҰҒХО АҚ резидент - ангиохирургі.*
Нурмаганбет С.Т. *– А.Н. Сызганов атындағы ҰҒХО АҚ резидент - ангиохирургі.*
Шарифова Б.К. *– А.Н. Сызганов атындағы ҰҒХО АҚ резидент - ангиохирургі.*

Түйін сөздер
қант диабеті, периферия артерия аурулары, ампутация.

Роль сахарного диабета в развитии заболеваний периферических артерий и современные способы реваскуляризации артерий нижних конечностей (обзор литературы).

Жакубаев М.А.[1,2], Егембердиев Т.Ж.[2], Маткеримов А.Ж.[1], Баубеков А.А.[1,2], Тергеусизов А.С.[1], Таджибаев Т.К.[1], Шамшиев А.С.[1], Садуакас А.Е.[1], Маккамов Р.О.[1], Нурмаганбет С.Т.[1], Шарифова Б.К.[1]

[1]АО «Национальный научный центр хирургии им. А.Н. Сызганова», Алматы, Казахстан
[2]АО «Национальный медицинский университет» Алматы, Казахстан

ОБ АВТОРАХ

Жакубаев М.А. *– PhD докторант КазНМУ им С.Д. Асфендиярова, сосудистый хирург отделения ангиохирургии АО ННЦХ им. А.Н. Сызганова;*
Егембердиев Т.Ж. *- профессор, д.м.н., зав.курсом сердечно-сосудистой хирургии кафедры хирургических болезней №3 КазНМУ им. С.Д. Асфендиярова;*
Маткеримов А.Ж. *– заведующий отделом ангиохирургии АО ННЦХ им. А.Н. Сызганова;*
Баубеков А.А. *- PhD докторант КазНМУ им. С.Д. Асфендиярова, сосудистый хирург отделения ангиохирургии АО ННЦХ им. А.Н. Сызганова;*
Тергеусизов А.С. *- врач-ангиохирург АО ННЦХ им. А.Н. Сызганова;*
Таджибаев Т.К. *– врач-ангиохирург АО ННЦХ им. А.Н. Сызганова;*
Шамшиев А.С. *– врач-ангиохирург АО ННЦХ им. А.Н. Сызганова;*
Садуакас А.Е. *– Резидент ангиохирург АО ННЦХ им. А.Н. Сызганова;*
Маккамов Р.О. *- Резидент ангиохирург АО ННЦХ им. А.Н. Сызганова;*
Нурмаганбет С.Т. *- Резидент ангиохирург АО ННЦХ им. А.Н. Сызганова;*
Шарифова Б.К. *- Резидент ангиохирург АО ННЦХ им. А.Н. Сызганова.*

Ключевые слова
сахарный диабет, заболевания периверических артерий, ампутация.

Аннотация

Сахарный диабет (СД) является одним из приоритетных заболеваний в системе здравоохранения всех стран мира, что обусловлено высокой распространенностью данной патологии в популяции и ростом социально-экономических потерь, связанных с развитием тяжелых инвалидизирующих осложнений. Каждый год в мире производят более 1 миллионов операций по ампутации нижних конечностей при сахарном диабете, более 600 тысяч больных теряют зрение, приблизительно у 500 тысяч пациентов развивается почечная недостаточность. Более 50% всех нетравматических ампутаций приходится на долю больных сахарным диабетом. В статье проводится литературный обзор, охватывая зарубежные и отечественные данные. Обзор посвящен современным подходам к различным видам диагностики и лечения заболеваний периферических артерий, обусловленные сахарным диабетов, сравнительные исследования, а так же методы профилактики.

Diabetes mellitus (DM) is one of the priority diseases in the health care system of all countries of the world, due to the high prevalence of this pathology and the increase in socio-economic losses due to the presence of disabling complications. Social significance is due to chronic complications, leading to early disability, deterioration of quality of life and reduction of its life expectancy. These include microangiopathy (nephropathy, acute coronary death, retinopathy, coronary heart disease, angina), peripheral vascular disease, diabetic foot syndrome, including gangrene, cerebrovascular disease (transient cerebral ischemia, stroke), diabetic neuropathy. According to the WHO, one person with diabetes dies every 10 seconds in the world; - about 4 million people. Every year, more than 1 million operations on amputation of lower extremities in diabetes are performed in the world, more than 600 thousand patients lose their sight, approximately 500 thousand patients develop renal failure [1]. International Diabetic Federation leads to complications caused by diabetes: every 12 min. registered stroke, 15 min. - amputation, 18 min. - myocardial infarction, 30 min; - blindness, the need for dialysis - 90 min [2].

In the predominant half of people suffering from type 2 diabetes, the disease progresses, leading to serious complications. Often, from the onset of the disease and the formulation of the diagnosis itself, it takes a long time, during which late complications develop, which are the main cause of disability and death. Diabetes in 70-80% of cases, leads to the development of cardiovascular diseases, cerebrovascular diseases, diabetic retinopathy and blindness, diabetic foot and the development of gangrene of the lower extremities. Diabetes of the second type leads to an increase in the risk of cardiovascular diseases by 2 times, blindness by 10 times, amputations of the limbs by 20 times [3]. Over 50% of all non-traumatic amputations are accounted for by diabetics. At the same time, half of all amputations can be prevented, as well as it is possible to prevent vision loss by patients due to the development of retinopathy and cataracts in them. These facts make the need for early diagnosis of complications vital, and the late detection of these complications can lead to the emergence of medical and social problems [4]. Diabetes worldwide is recognized as one of the most important non-communicable diseases, ranking fourth among causes of death in developed countries. The number of patients with diabetes mellitus is constantly growing due to an increase in the number and age of the population, the urbanization of the territory, the prevalence of obesity and a sedentary lifestyle [5]. In Kazakhstan, according to the National Register of Diabetes mellitus for 2012, the number of patients with diabetes has reached 207,935 people. According to the IDF Diabetes Atlas for 2017, the prevalence of diabetes in Kazakhstan among adults

is 6.97%. In 2045, the expected increase in diabetes will be 7.74%. Diabetes worldwide is recognized as one of the most important non-communicable diseases, ranking fourth among causes of death in developed countries. The number of patients with diabetes mellitus is constantly growing due to an increase in the number and age of the population, the urbanization of the territory, the prevalence of obesity and a sedentary lifestyle [5]. In Kazakhstan, according to the National Register of Diabetes mellitus for 2012, the number of patients with diabetes has reached 207,935 people. According to the IDF Diabetes Atlas for 2017, the prevalence of diabetes in Kazakhstan among adults is 6.97%. In 2045, the expected increase in diabetes will be 7.74%.

PAD in patients with diabetes is much more aggressive, with early involvement of large vessels, together with distal symmetric neuropathy. The need for high amputation in diabetics occurs 5-10 times more often than non-diabetics. Sensory neuropathy contributes to an increase in the frequency of amputations with a decrease in resistance to the development of infectious complications. Based on this evidence, the American Diabetes Association recommends screening patients with diabetes for PAD and measuring the ankle-brachial index every 5 years [13]. Arthropathy of arteries is 3 times more common in patients with diabetes. The percentage of occurrence in patients with diabetes who are over 50 years old is 29% [14,15].

According to the IDF (International Diabetes Federation), the prevalence of diabetes in adults (20–79 years old) is on average 5.1% (of which 90% is in the proportion of diabetes II) [16,17]. About 10% of elderly patients with diabetes have an ulcer or gangrene of the foot. In the structure of ulcers in diabetic foot syndrome, 48% are neuroischemic and 7% ischemic. Thus, 55% of ulcers in diabetic patients develop against the background of critical lower limb ischemia [18].

According to the international recommendations of TASC II, the frequency of critical lower limb ischemia is 500–1000 cases per 1 million population per year. In the structure of the incidence of critical ischemia of the lower extremities, the proportion of elderly and senile patients is 80% [19,20].

To date, there is a constant discussion of treatment methods for PAD: which method is best used in a particular case. The rapid development of the arsenal of interventional surgery does not detract from the results of open revascularization of the peripheral arteries. What method of revascularization is acceptable for a particular patient is still a pressing issue. There is a sufficient amount of research regarding the methods of treatment of peripheral arterial diseases, however, the issue of limb preservation, prevention of mortality, improvement of the quality of life in such patients remains insufficiently studied [21]. Prior to the publication of the directive of the American College of Cardiology / American Heart Association in 2011, there were no precise recommendations on the use of revascularization techniques. This publication referred to the Bypass versus Angioplasty in Severe Ischemia of the Leg (BASIL), a single-center, randomized study that showed similar results in patients with critical limb ischemia after endovascular and open surgery [22].

The 2007 Inter-Community Consensus Document for the Management of Patients with PAD (TASC II) and the 2012 National Institute of Health and Clinical Quality of the Kingdom of Great Britain (NICE) published recommendations on the diagnosis and treatment of peripheral arterial disease. However, the proposed recommendation does not provide sufficient data on the management of patients with PAD, with concomitant diabetes [23, 24].

Obliterating diseases of the lower limb arteries associated with diabetes, for the most part, have a lesion of the distal segments of the tibial arteries, which in turn requires shunting of the arteries of the rear foot, plantar artery and more distal posterior minor tibial artery [25]. Clinical manifestations of arterial lesions below the popliteal fossa are mostly manifested as critical lower limb ischemia than intermittent claudication. Infrapopliteal damage to arteries is more common in patients with diabetes and renal failure [26]. The caliber of the arteries is smaller than the arteries above the knee, and the lesion of the arteries is extensive [27]. The disease is characterized by media calcification or Mockenberg sclerosis, as a result of which the lumen of the vessel narrows, which is different from isolated atherosclerosis, in which the pathological process occurs in the intimal layer of the vessel [28]. Arteries below the knee have a greater involvement in diabetic patients. It should be noted that the incidence of trophic disorders of the lower limbs and life-threatening infections are more common in patients with diabetes [29,30].

According to the literature there is a sufficient amount of research that compares various treatment methods. So in a randomized clinical trial of BASIL, initiated by the UK, 452 patients with lesions of the lower limb arteries participated. In this study, two methods of treatment were compared: endovascular treatment, surgical treatment in patients with lesions of the infrainguinal arteries, where one third of the patients underwent shunting operations on the arteries of the lower leg and 62% of patients with balloon angioplasty of the superficial hip artery. Separately, there was no assessment of the results in the subgroup with the infra-popular

lesion of the arteries [31]. The worst result and the highest probability of high amputation is observed in patients with diabetes and with concomitant PAD [32]. Despite the constantly improving technique of minimally invasive endovascular procedures, bypass surgery, patients with PAD are still in demand [33].

Abd Moain Abu Dabrh MBBCh, MS together with co-authors conducted a systematic review on the topic: Distal bypass surgery against endovascular intervention for critical lower limb ischemia, including 9 studies, 3 of which are randomized clinical studies and 6 cohort studies. The conclusion of the review is that there is an identical effect on mortality and large amputations no matter what type of intervention was used. However, the primary patency when performing open surgery is higher. But, further research is needed with the inclusion of additional endpoints [34]. Endovascular interventions are considered safer in terms of morbidity and mortality, but the risk of failure of the interventional procedure may be higher compared to distal bypass surgery [35]. The Inter-Community Transatlantic Consensus Document (TASC II) recommends arterial revascularization as the most appropriate treatment option, but the method of revascularization remains debatable [36].

Nasser M. Malyar and co-authors, in their study, evaluated the immediate and long-term results in patients with diabetes complicated by a lesion in the lower limb arterial pool and a diabetic foot in Germany. The authors divided patients, the number of which reached up to 40,335, into 3 groups: patients with diabetic foot, patients with diabetes and PAD, patients with PAD without diabetes. Greater amputation was more common in patients with diabetic foot in comparison with the group of diabetes in combination with PAD and isolated lesions of the lower limb arteries (31.9% versus 11.1% versus 6%). Also in the question of 4-year survival (57.4%, 60.8% and 70.0%) and limb preservation (45.4%, 74.4% and 86.5%), a group of patients with diabetic foot and Diabetes, combined with damage to the arteries of the lower extremities, had worse results. In conclusion, the authors summarized the need to study the factors influencing the prognosis in patients with diabetes and PAD [37].

In a study conducted by Yisu Gu and co-authors, the results of conservative treatment and various types of revascularization were assessed in patients with diabetes, where there was no significant difference in limb preservation after 1 year of follow-up. But, in the future, after 5 years of observation, in patients after revascularization, the chances of maintaining the limb were higher, the mortality rate was lower compared to the group where the drug therapy was carried out [38].

D. W. Good and co-authors conducted a study where 24 patients, 19 of whom suffered from diabetes, underwent popliteal pedal autovenous shunting. For 5 years, an observation was conducted in which the frequency of limb preservation reached 81.8% after 1, 3, 5 years. All 3 amputations were performed in the first 3 months. In conclusion, the authors consider distal shunting - popliteal-pedal autovenous shunting as an effective treatment. However, a randomized study is required, where endovascular treatment would be compared [39].

Lee MS et al. Evaluated the clinical outcome in patients with PAD with and without diabetes who underwent balloon angioplasty. After two years of observation, it was revealed that the frequency of restenoses and amputations is higher in the group of patients with diabetes [40].

Discussion

It is worth noting that diabetes remains a dynamically developing disease that can make its own adjustments to the patient's quality of life. Complications arising from the presence of diabetes, in particular, the PAD of interest to us, significantly aggravates the course of the disease, in comparison with the lesion of the arteries of the lower extremities in isolation from atherosclerosis. The fact that diabetes is one of the main factors of non-traumatic amputations of the lower extremities encourages us to search for optimal treatment methods to save the limb, reduce deaths and improve the quality of life of patients. Currently, there are two main methods of treatment for PAD: open surgery and interventional surgery. The end point of the existing methods in stopping the signs of ischemia, by restoring blood circulation in the basin of the lower extremities. The arsenal for endovascular interventions is inexorably increasing, which expands the field of activity for revascularization of the affected arteries. But, open surgery also does not stand still. If earlier, the lesion of the arteries immediately under trifurcation was considered unacceptable for the reconstruction of the arterial bed, and treatment was limited to palliative or drug therapy, today the revascularization of the arteries of the leg and foot by a surgical method has become possible. Based on the above, there remains an open question about the best way to treat PAD, with concomitant diabetes. In connection with the continuity of a particular school, the opinions of many authors are divided. According to the classification of TASC II, A, B in lesions of the infra-juvial arteries, among the authors there is an agreement on the method of revascularization. But, with TASC C, D, the method of revascularization remains insufficiently studied.

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