American Journal of Medicine and Medical Sciences 2019, 9(5): 163-166
DOI: 10.5923/j.ajmms.20190905.01

Efficacy of Minimally Invasive Procedures in the Treatment of Lower Extremities Diabetic Gangrene

B. D. Babadjanov, K. J. Matmurotov*, T. Sh. Atajanov

Department of General Surgery, Tashkent Medical Academy, Tashkent, Uzbekistan

Abstract The results of the study and inpatient treatment of 311 patients were analyzed with purulent-necrotic complications of DFS in the Republican Center of purulent surgery and surgical complications of diabetes at the 2nd clinic of the Tashkent Medical Academy. All patients suffered from type 2 diabetes. Thus, minimally invasive endovascular interventions are most effective in treating diabetic gangrene of the lower extremities. Conducting intra-arterial catheter therapy with the administration of drugs after balloon angioplasty with improved blood circulation in patients with foot purulent-necrotic lesions against the background of critical ischemia increases the chances of preserving the musculoskeletal function of the lower extremities to 88.3%.

Keywords Diabetes mellitus, Critical Ischemia, Gangrene, Purulent-necrotic process

1. Introduction

Diabetic foot syndrome (DFS) is defined as an infection, an ulcer and/or destruction of deep tissues associated with neurological disorders and / or a decrease in the main blood flow in the arteries of the lower extremities of varying severity. Despite the new methods of diagnosing and treating diabetic gangrene, the frequency of limb amputations on the background of diabetes mellitus remains high [1].

Currently, a number of classifications of DFS have been proposed, based on ideas about the main pathogenetic mechanisms for the development of this diabetic complication, which takes into account the severity of damage to the peripheral nervous system, the peripheral arterial bed, the size of the wound defect and the severity of the infection process [2, 5].

Diabetic gangrene of the lower extremity is a serious complication of diabetic foot syndrome on the background of diabetes mellitus. The severity of this complication is determined not only by the mental trauma caused by the understanding of leg loss and disability, but also by the real danger of the death of the patient. Mortality after limb amputation is currently 20–33% [1, 3, 5]. Amputations performed below the knee joint are accompanied by reamputations in almost 40% of patients. Complications and defects of the stump in one form or another occur in 30–35% of operated patients [2, 7, 8].

The lesion of the peripheral arterial bed in patients with diabetes is most closely associated with bilateral amputation [4, 6]. Literature data showed that large amputations range from 48.9 to 60%, while according to cohort studies this number is 24% [5].

Historically, the gold standard for the treatment of critical lower limb ischemia (CLLI) is surgical revascularization (endovascular treatment), but this method can only be used in patients with a good distal recipient vessel without severe concomitant pathology. The prospects of balloon angioplasty are determined by the following factors: the achievement of adequate results at lower costs, a low rate of complications, the possibility of repeated interventions and insignificant mortality. All this opens up great opportunities in the application of this method in the treatment of CLLI [8].

Despite the long history of amputation, a large number of scientific studies, the treatment of patients with gangrene of the limb on the background of diabetes is an unsolved extremely urgent, not only medical, but also a social problem [9, 10].

In this regard, the purpose of this study was to assess the effectiveness of minimally invasive methods in the treatment of patients with gangrene of the lower extremities against the background of diabetes mellitus.

2. Material and Methods

The results of the study and inpatient treatment of 311 patients for 2012-2018 were analyzed with purulent-necrotic complications of diabetic foot syndrome in the Republican Center of purulent surgery and surgical complications of diabetes at the 2nd clinic of the Tashkent Medical Academy.

* Corresponding author:
mqj_80@mail.ru (K. J. Matmurotov)
Published online at http://journal.sapub.org/ajmms

All patients suffered from type 2 diabetes. In 63% of cases (203) patients for the correction of blood sugar received insulin.

The average duration of diabetes was 14.7±5.2 years. The age of patients ranged from 47 to 81 years (on average, 62.3±6.8 years). Among male patients, there were 217 (69.7%) and 94 (30.3%) women. The neuroischemic form of diabetic foot syndrome was diagnosed in 262 (84.2%) patients, ischemic form - in 49 (15.8%).

The main instrumental method of assessing the state of macrocirculation was duplex scanning of the lower extremities, performed on the Acuson-128 XP/10 ultrasonic duplex system (Acuson, USA) by a standard technique using a linear sensor with a frequency of 7-15 MHz and multispiral computed tomography of the lower limb arteries (MSCT). After checking renal activity and normalizing renal tests (urea, creatinine), all patients underwent MSCT, which determined the level of stenosis and occlusion of peripheral arteries, the degree of artery narrowing, the extent of the lesion and the exact location of atherosclerotic plaques.

After the establishment of the affected segment (occlusion and/or stenosis) of the segment, transluminal balloon angioplasty (TLBAP) of the lower limb arteries was performed in all patients. Balloon angioplasty was carried out strictly according to the angiosomal structure of the foot and lower leg, and these patients were conditionally divided into 2 groups. In the first group, 252 (81%) patients received only BAP. Of the 323 patients after balloon angioplasty, 59 (19%) patients of group 2, in connection with severe purulent-necrotic process of the foot and critical ischemia, prolonged intra-arterial catheter therapy (PIACT) was done with catheterization of the external iliac artery on the affected side. The duration of PIACT was from 3 to 5 days with continuous administration of drugs. After improving blood circulation, small surgical interventions were performed on the foot.

3. Results and Discussion

When analyzing the affected segments of the peripheral arterial bed, patients often had a lesion of two arteries of the lower leg - anterior and posterior tibial (ATA and PTA) - 22.2%.

An isolated lesion of the superficial femoral artery (SFA) was observed in 52 (20.6%) patients and, together with isolated occlusion of the PTA, was distinguished by a malignant course. In these patients, high limb amputations were often performed (half of all amputations) (Table 1).

Table 1. Analysis of the results of treatment in patients performed TLBAP (n=252)

№	Lesion segment	Number of patients	Amputation of fingers	Necro-ectomy	Amputation by Sharpe	Amputation of the leg	Hip amputation	Mortality
1.	External iliac artery	3 (1,2)	1 (33,3)	1 (33,3)	-	-	-	-
2.	Superficial femoral artery	52 (20,6)	27 (52,0)	16 (30,7)	7 (13,4)	8 (15,3)	4 (7,7)	3 (5,7)
3.	Popliteal artery	31 (12,3)	8 (25,8)	15 (48,4)	4 (13,0)	1 (3,2)	1 (3,2)	1 (3,2)
4.	Posterior tibial artery	25 (9,9)	6 (24)	11 (44,0)	-	4 (16,0)	1 (4,0)	4 (16,0)
5.	Anterior tibial artery	31 (12,3)	11 (35,4)	14 (45,1)	6 (19,3)	3 (9,6)	-	2 (6,4)
6.	fibular artery	4 (1,6)	2 (50,0)	-	-	-	-	-
7.	Anterior and posterior tibial arteries	62 (24,6)	31 (50,0)	17 (27,4)	9 (14,5)	5 (8,0)	2 (3,2)	3 (1,6)
8.	Two different segments	44 (17,4)	7 (16,0)	11 (25,0)	4 (9,1)	3 (8,0)	1 (1,6)	2 (3,2)
Total		252 (100)	93 (36,9)	85 (33,7)	30 (12)	24 (9,5)	9 (3,5)	15 (6,0)

With a lesion of the popliteal artery (PA) after balloon angioplasty, staged necrotomy was most often performed (48.4%). This indicates the great role of the popliteal arterial network in compensating for the circulation of the foot ("rete genu").

In the long term (72 months) after performing balloon angioplasty of the lower limb arteries, 15 (6.0%) cases were fatal. Half (8) of the patients had a fatal outcome from acute myocardial infarction and coronary syndrome (AMI and ACS), in 4 (33.3%) cases there was an acute cerebrovascular accident (ACVA), one patient died from uremic coma and 2 (13.3%) the cause of death has not been established.

59 (18.9%) patients with severe purulent-necrotic lesion and critical ischemia of the lower limb the next day or two days after the TLBAP, a catheter (F5) was installed in the external iliac artery on the affected side for intensive intra-arterial drug administration using a dosimeter. This procedure lasted from 3 to 5 days.

It should be noted that in the patients who received PIACT, in most cases, isolated superficial femoral artery lesion was

observed (33.9%) and two lower leg arteries - 23.6% (anterior tibial artery and posterior tibial artery) (Table 2). Staged necrotomies (32.2%) were performed in the most frequent patients who received PIACT.

These data in turn shows that, against the background of PIACT with the introduction of antibiotics, angioprotectors and anticoagulants, can lead to rapid relief of purulent-inflammatory process and improve local blood circulation, thereby accelerating the appearance of the demarcation line in the lesion.

Minor surgeries on the foot (amputation of toes – 37.9%, necrectomy – 27.5% and amputation by Sharpe – 24.1%) are often performed in patients with lesions of the arteries of the lower leg (89.6%). With the defeat of two or more arterial segments, these surgeries were performed in all cases (Table 2).

As can be seen in Table 2 patients who received PIACT managed to maintain the support function of the limbs in 84.7% of cases, only 5 (8.4%) patients had to perform amputation of the limb due to the progression of the purulent-necrotic process. Amputation above the knee of the hip in one patient due to total occlusion of the superficial femoral artery.

Amputation at the level of the leg was performed in 4 (6.7%) cases. Fatal outcome was observed in 2 patients (3.3%). One patient died after hip amputation, in the second patient with a total occlusion of all the arteries of the lower leg, died of acute myocardial infarction.

Thus, an analysis of the dependence of the risk of amputations on the nature and localization of purulent-necrotic lesions showed that with isolated balloon angioplasty in patients with diabetic gangrene of lower extremities (DGLE) the number of amputations (above and below the knee joint) is 13%.

The most aggressive course of purulent-necrotic lesions of the feet was observed in patients with occlusive-stenotic lesions of PTA and SFA. A segmental or total lesion of the PTA led to limb amputations in 20% of cases and in 4 (16%) deaths were observed.

Table 2. Analysis of the results of treatment in patients undergoing PIACT after TLBAP (n=59)

№	Lesion segment	Number of patients	Amputation of toes	Necrectomy	Amputation by Sharpe	Leg's amputation	Hip amputation	Mortality
1.	Superficial femoral artery	20 (33,9)	3 (14,2)	6 (28,5)	7 (33,3)	2 (9,5)	1 (4,7)	1 (4,7)
2.	Popliteal artery	4 (6,7)	2 (50,0)	1 (25,0)	-	-	-	-
3.	Posterior tibial artery	3 (5,0)	1 (33,3)	1 (33,3)	-	-	-	-
4.	Anterior tibial artery	11 (18,6)	4 (36,3)	2 (18,1)	3 (27,2)	-	-	-
5.	Anterior and posterior tibial arteries	15 (25,4)	6 (40,0)	5 (33,3)	4 (26,6)	2 (13,3)	-	1 (6,7)
6.	Two different segments	6 (10,1)	1 (16,7)	4 (66,7)	1 (16,7)	-	-	-
Total		59 (100)	17 (28,8)	19 (32,2)	15 (25,4)	4 (6,7)	1 (1,7)	2 (3,3)

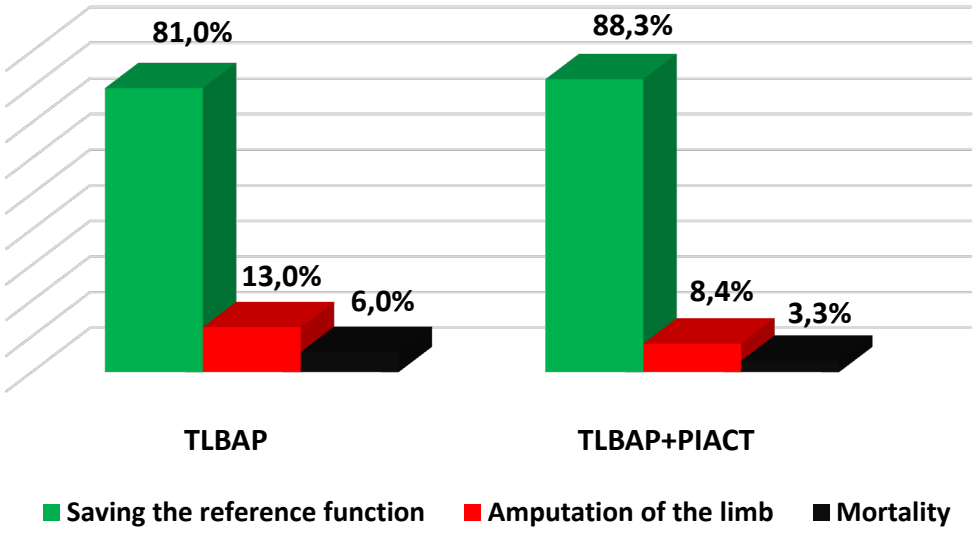

Figure 1. Comparative analysis of the results of treatment of patients

The performance of an adequate isolated revascularization of the peripheral arteries of the extremities and the complex of therapeutic measures carried out in 81.0% of cases led to the preservation of the support function of the limb. The catheterization of the NLA with the conduct of PIACT improved the result by 7.3% and this shows the effectiveness of the integrated use of minimally invasive treatment methods for gangrene of the lower extremities against the background of diabetes mellitus.

4. Discussion

A comparative analysis of the results of patients who received intra-arterial catheter therapy showed that these patients most often from minor surgeries on the foot were performed stepwise necrotomy (32.2%), due to the appearance of a demarcation line in the lesion for a short time and a sharp decrease in purulent inflammatory process. Despite the conducted medical procedures, amputation of the limb was performed in 5 (8.4%) cases.

Thus, minimally invasive endovascular interventions are most effective in treating diabetic gangrene of the lower extremities. Conducting intra-arterial catheter therapy with the administration of drugs after balloon angioplasty with improved blood circulation in patients with foot purulent-necrotic lesions against the background of critical ischemia increases the chances of preserving the musculoskeletal function of the lower extremities to 88.3%.

Findings

1. Revascularization of the lower limb arteries is a highly effective method of treatment in the rescue of the limb in patients with diabetic gangrene of the lower extremities and, in the presence of purulent-necrotic processes against the background of critical ischemia of the foot, in 81.0% of cases it will be possible to save the limb.

2. After the restoration of the blood flow of the peripheral arterial bed of the lower extremities, the introduction of drugs using intra-arterial catheters increases the chances of maintaining the support function of the limb to 88.3% and reduces mortality by 3.3%.

3. Conducting comprehensive minimally invasive treatment methods, allowing us to achieve the expected result even in patients with a critical situation and thereby improve their quality of life.

REFERENCES

[1] Abyshov N.S., Zakirjayev E.D. The immediate results of “large” amputations in patients with occlusive diseases of lower limb arteries // Surgery. Journal them. N.I. Pirogov. –2005.– №11. - P.15-19.

[2] Gaibov A.D., Gaibov A.D., Kamolov A.N. Amputations of the lower limbs during their chronic critical ischemia // Cardiology and cardiovascular surgery. – 2009. – №2. - C.40-46.

[3] Zoloev G.K. Obliterating diseases of the arteries. Surgical treatment and rehabilitation of patients with loss of limb // M.: Medicine. – 2016. – 432 p.

[4] Pokrovsky A.V., Zotikov A.E. Prospects and reality in the treatment of atherosclerotic lesions of the aorta // M.: Meditsina. – 2008.-192 p.

[5] Saveliev B.C., Koshkin B.C., Karalkin A.B. Pathogenesis and conservative treatment of severe stages of atherosclerosis obliterans of lower limb arteries // M.: MIA. –2010. – 214 p.

[6] Biamino G. et al. Critical limb ischemia: new techniques for complex interventions // HMP Communication. –2014. –P. 72.

[7] Castelli G. et al. Procalcitonin and C-reactive protein during systemic inflammatory response syndrome, sepsis and organ dysfunction // Critical Care.–2013.–Vol. 8.–P. 234-242.

[8] Dormandy J.A. et al. Major amputations // Semin Vase. Surg.–2009 –Vol. 73.–P. 321.

[9] Eskelinen E. et al. Major amputation incidence decreases both in non-diabetic and in diabetic patients in Helsinki // Scandinavian Journal of Surgery.–2016.–Vol.95.– P. 185-189.

[10] Johannesson A. et al. Incidence of lower-limb amputation in the diabetic and nondiabetic general population // Diabetes Care.–2011.–Vol.32.– №2.– P.275–280.