

**APPLICATION BY TRANSCUTANEOUS OXIMETRY FOR DETERMINATION OF  
LEVEL OF AMPUTATION OF THE CRUS AT CRITICAL ISHEMIA OF THE LOWER  
EXTREMITIES AT PATIENTS WITH DIABETES****<sup>1</sup>Valery Afanasyevich Mitish, <sup>2</sup>Bakodir Barnoyevich Safoyev and <sup>1,2</sup>\*Azizzhon Yakhyoevich Rakhimov**<sup>1</sup>National Research Center of Surgery of A. V. Vishnevsky.<sup>2</sup>Bukhara State Medical Institute.**\*Corresponding Author: Azizzhon Yakhyoevich Rakhimov**

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**ABSTRACT**

**Background:** According to the latest data today diabetes mellitus - one of the most widespread endocrine pathologies in the world. Atherosclerosis of vessels is the reason of an origin of critical ischemia of the lower extremities (CILE) in 80-90% of cases. Patients with DM and CILE represent heavy group of patients with high risk of failures. Frequency of amputations remains high at persons with DM and now. One of the most worthy and methods of a research often now in use of a condition of the microcirculatory course is the transcutaneous oximetry. From the offered methods the transcutaneous oximetry shows to sufficient informational content for determination of optimum level of amputation. **Objective:** The results of treatment of 41 patients operated apropos by the mixed infected forms of diabetic foot with critical ischemia of the lower extremities are subjected to the analysis. **Methods:** 19 examined patients amputated at the level of a crus the line of border of amputation determined before operation on indicators the basal level of oxygen not less than 30 mm Hg. **Result:** Given to a transcutaneous oximetry (tcpO<sub>2</sub>) at these patients showed that in a zone of the expressed fabric hypoxia the sowing of high level of microflora is noted. **Conclusion:** The analysis of the received results of our research was shown that at severe forms of critical ischemia of the lower extremity modern method is amputation at the level of a crus by Mitish. The combination of operation of Mitish to application transcutaneous oximetry (tcpO<sub>2</sub>) before operation promotes will lower postoperative purulent complications of a stump.

**KEYWORDS:** Diabetes mellitus, critical ischemia of the lower extremities, amputation, transcutaneous oximetry.**INTRODUCTION**

According to the latest data today diabetes mellitus - one of the most widespread endocrine pathologies in the world. One of the most frequent localizations of atherosclerotic defeat of vascular system is arteries of the lower extremities, leading at early stages of a disease to a syndrome of the alternating lameness, and at late stages - to gangrene. Atherosclerosis of vessels is the reason of an origin of critical ischemia of the lower extremities (CILE) in 80-90% of cases. Especially often this pathology is observed at persons 60 years are more senior.<sup>[1,5]</sup>

Patients with DM and CILE represent heavy group of patients with high risk of failures. According to Jude E.B mortality at patients with DM and CILE makes 30% within 5 years.<sup>[3,4,8]</sup>

Frequency of amputations remains high at persons with DM and now. According to Vamos, in Great Britain, from 2004 to 2008 a half from total number of not traumatic amputations is made at patients with DM.<sup>[2,7]</sup>

One of the most worthy and methods of a research often now in use of a condition of the microcirculatory course is the transcutaneous oximetry. Measurement of partial pressure of oxygen in the field of the back of foot, on a crus is valuable noninvasive easily feasible method of diagnostics of Diseases of peripheral arteries (DPA) at patients with diabetes.<sup>[1,9,11]</sup>

According to literary data, it is normal of tcpO<sub>2</sub> on foot > 40 mm Hg (T. Rooke et.al. 1998). For more exact diagnosis of ischemia of an extremity when carrying out a transcutaneous oximetry, including, at patients with the obliterating atherosclerosis, it is necessary to estimate, both the basal tcpO<sub>2</sub> level, and dynamics of changes when conducting functional tests at patients with the obliterating atherosclerosis of arteries of the lower extremities of more informative orthostatic test with lowering of a leg is considered (Scheffler A. et al 1992).

Measurement of tcpO<sub>2</sub> before surgical intervention is one of informative methods of diagnostics for implementation of dynamic observation. Now tcpO<sub>2</sub> is

widely applied also to assessment of efficiency of the moved endovascular intervention on arteries of the lower extremities.<sup>[6,12]</sup>

Advantages of a method of a transcutaneous oximetry at DM in comparison with measurement of malleolar humeral index (MHI), finger humeral index (FHI) and segmentary pressure consist in bigger informational content when screening DPA, determining CILE, assessment of level of amputation of an extremity, the forecast of healing of ulcer defect and independence of weight of a mediocalcinosis of peripheral arteries.<sup>[4,10]</sup>

From the offered methods the transcutaneous oximetry shows to sufficient informational content for determination of optimum level of amputation, is not a difficult procedure and who can be used for broad application in routine clinical practice.

### Research objective

Improvement of results of treatment after operating is purulent - the necrotic complications amputated at the level of a crus of patients with diabetes at critical ischemia of the lower extremity in the way, applications of a transcutaneous oximetry for determination of level of amputation.

**Table 1: Duration of critical ischemia.**

Duration of a disease (diabetes)	Absolute number	In %
4-5 years	5	12,2
6-10 years	9	21,9
10 years and more	27	65,9
In total	41	100

From the surveyed 41 DFS from critical ischemia of the lower extremities at 19 patients measurement of partial pressure of oxygen by means of transcutaneous oximetry in the lower extremities in various points of a crus the presurgical period for determination of optimum level the line of border of amputation was carried out.

The transcutaneous oximetry (tpcO<sub>2</sub>) was carried out by means of the device "Radiometer" (Denmark). Determinirovany fabric saturation of oxygen allows to predict postoperative complications of a stump.

Studying of a functional condition of vessels was carried out by means of duplex scanning.

Besides, at all patients it is studied intoxication indicators: body temperature, LII of blood, SOE, average molecule of blood. In the course of treatment experts participated: surgeon, endocrinologist, anesthesiologist and cardiologist.

### Results of a research and their discussion

Given to a transcutaneous oximetry (tpcO<sub>2</sub>) at these patients showed that in a zone of the expressed fabric hypoxia the sowing of high level of microflora is noted.

### MATERIALS AND METHODS

Results of treatment of 41 patients operated apropos by the mixed infected forms of diabetic foot with critical ischemia of the lower extremities are subjected to the analysis.

All patients were heavy degree of DFS from critical ischemia of the lower extremities (Wagner III-IV-V). Amputation at the level of a crus was it is executed on the developed way of operation by the staff of the National research center of surgery of Vishnevsky in 1997 (V. A. Mitish).

The age of patients varied from 41 to 74 years which middle age made  $57 \pm 0,5$  years. Disease duration with critical ischemia from 4th to 18 years, the average duration of a disease is  $11 \pm 0,5$  years. the Diabetic anamnesis revealed (tab. 1) that among 41 patients 2(4,9% have a diabetes) is revealed for the first time. These patients learned about the disease only after receipt in our clinic concerning gangrene of the lower extremity of 28(68,3%), patients had 4 and over a year the diabetic anamnesis, the average duration of a disease made  $10 \pm 2,5$  years.

The analysis of results indicators of the general intoxication of an organism are given in table 2.

In the first days of treatment the body temperature of patients averaged  $38,6 \pm 0,30C$ . The maintenance of leukocytes of blood was equal on average  $9,4 \pm 0,5$  10<sup>9</sup>/l•. The volume of average molecules compiled  $0,216 \pm 0,011$  pieces. Similar to it increase in indicators of leukocyte intoxication index (LII) and erythrocyte sedimentation rate (ESR) to  $2,5 \pm 0,18$  and  $49,1 \pm 2,4$  respectively was noted. The increased level mass of average molecule (MAM), L, LII, and ESR, indicated the expressed endotoxycosis at this category of patients.

**Table 2: Dynamics of change of indicators of intoxication at surveyed patients (n=19).**

Indicators	Norm	Days				
		First days	After operation	3 days p/o	7 days p/o	9 days p/o
body t <sup>0</sup>	36,6	38,6±0,3	37,4±0,3 *	36,7±0,4	36,6±0,4	36,6±0,2
L-blood	6,0	9,4±0,5	7,8±0,3 *	7,0±0,4	6,2±0,3	5,6±0,3
MAM	0,120	0,216±0,011	0,174±0,014 *	0,116±0,012	0,101±0,011	0,098±0,012
LII	1,2	2,5±0,18	1,8±0,14 *	1,3±0,12	1,1±0,2	1,0±0,2
ESR	10	49,1±2,4	37,2±2,1 *	24,7±1,3 *	12,7±1,6 *	10,5±1,6

The note where \* P < 0,05 – a reliability indicator in relation to the last days treatments.

On third day of treatment considerable decrease in these indicators of body temperature from 38,6±0,30C to level 36,7±0,40C was noted, the quantity of leukocytes of blood decreased, on average, to 7,0±0,4 10<sup>9</sup>/l. Content of the MAM blood decreased to 0,116±0,012 pieces. Changes of indicators of LII by 3rd days of treatment also tended to decrease in from 2,5±0,18 to 1,3±0,12 pieces. At this ESR decreased, on average, to 24,7±1,3 \* mm/g.

By seventh days of treatment at the examined patients of control group got closer to norm (36,6±0,40C). At the same time on organism intoxication indicators: L, MAM, LII and ESR of blood was noted their further decrease, that is there was a tendency towards normalization – 6,2±0,3, 0,101±0,011, 1,1±0,2, 12,7±1,6 respectively.

It should be noted that in the course of treatment at normalization of all other indicators of intoxication, ESR of blood tended to slow normalization. Studying of level of content of sugar in blood showed that by the time of receipt in clinic, on average, it made 15,1±2,1 mmol/l. Elimination it is purulent - the necrotic center and the intensive therapy which is carried out in the postoperative period promoted decrease in level of sugar in blood to figures of the upper bound of norm only by 14-20 days of treatment.

From 19 examined patients amputated at the level of a crus the line of border of amputation not less than 30 mm Hg determined by indicators the basal level of oxygen. In early the postoperative period of suppuration of a stump of a wound to this group of patients were not observed. At 2 (10,5%) patients it is noted complications in the form of a seroma.

As it was stated above amputation at the level, a crus by which when determining the line of border of amputation it was not applied a transcutaneous oximetry is executed from 41 examined 22 patients of control group. The general state and indicators of laboratory analyses were synchronous.

From 22 examined patients of control group at 2 (9,1%) suppurations of a stump of the wound amputated knees in early the postoperative period were observed. For examination the suppuration reason at these patients were carried out a suppurations in various points proximal of the fabric left the top 1/3 parts amputated cruris. Results suppurations showed, all patients with a

complication have suppurations of a stump, a proximal part from 2 to 5 cm an indicator of tcpO<sub>2</sub> there were lower than 20 mm Hg that corresponds to III extent of disorders of microcirculation (decompensated fabric metabolism). This patient executed an extremity reamputation at the level of a femur.

### CONCLUSION

Thus, the analysis of the received results of our research was shown that at severe forms of critical ischemia of the lower extremity application of a modern method of amputation at the level of a crus across Mitish allows preservation of a knee joint that promotes decrease in an invalidization, after an operational lethality and complications. However, this method up to the end does not solve a problem as after operational complications, stump suppuration at the same time makes up to 9,1%. The combination of operation of Mitish to application transcutaneous oximetry (tcpO<sub>2</sub>) before operation promotes will lower postoperative purulent complications of a stump.

Results of our research show about need of a transcutaneous oximetry when determining level of amputation of crus at patients DFS from critical ischemia of the lower extremities and the oximetry demands to develop new methods of determination of optimum level of amputation even in the absence of a possibility of carrying out transcutaneous oximetry.

### SUMMARY

1. Amputation at the level of a crus across Mitish at DFS though is a modern method of treatment, but suppuration of a postoperative stump meets to 9,1%.
2. At purulent complications after amputation at the level of crus at DFS from critical ischemia of the lower extremities key, a role is played by a local hypoxia of fabric of a distal part of a stump.
3. DFS stump suppuration from critical ischemia of the lower extremities occurs at patients with indicators of a distal part of a stump tcpO<sub>2</sub> lower than 20 mm Hg.
4. For prevention of purulent complications at the amputated patients at the level of DFS crus from critical ischemia of the lower extremities it is necessary to determine amputation level taking into account indicators tcpO<sub>2</sub> crus tissues.
5. It is necessary to develop new methods of determination of optimum level of amputation in the

absence of a possibility of carrying out transcutaneous oximetry.

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