VASCULAR ASPECTS IN TREATMENT OF DIABETIC FOOT

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ABSTRACT
In half of the patients who had Diabetes Mellitus the leading component is the diabetic polyneuropathy. The ischemic component is in 25% of those patients, in the rest 25% to 30% the Diabetic foot is from mixed type. The classifications used in the Department of Vascular Surgery (DVS) are Arlt and Wagner. During our treatment of the complicated Diabetic foot we measure the effect of the applied methods. For the past two years, from 2012 till 2013 an object of our researches were 167 patients – 94 male and 73 female. The techniques we applied for treatment were: TEA, femoro–popliteal and femoro–distal By-pass, balloon dilatations with and without graft.

Key words: diabetic polyneuropathy, stenosis, microangiopathy, ulcus, callus

INTRODUCTION
The Diabetic foot is a specific complex of symptoms. Its pathological changes are reflected to the lower limbs and the feet due to the developing vascular-degeneration syndrome and the changes in the peripheral nervous system, typical for patients with diabetes mellitus.

Almost half of the cases had diabetic polyneuropathy. In 25% of them we found only an ischemic component, in the rest 25-30% the diabetic foot is of mixed type.

Specific for diabetes is the thickening of the basal membrane on the level of arterioles, precapillary and capillary. In most of the cases a complete obliteration of the vessels wasn’t found. Microangiopathy is associated not only with the effects of diabetes but also with atherosclerosis – there are storey stenosis to complete obliteration of the peripheral vessels of medium caliber. Polyneuropathy is due mostly to endoneurial vascular damage, which is leading to the demyelination of the peripheral nerves. The effect is: reduced sensitivity, especially for temperature, pain and touch.

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A specific configuration of the foot is developed during the progress of the Diabetic foot syndrome – typical deformations and hyperkeratosis (callus) as a result of atypical plantar loads. Often appears fissures (cracks) near the calluses and atypical deformations. Microtraumas, fungal infections between the toes and various minor injuries when wearing uncomfortable shoes are common. All of them can be a front door to the most trivial infection which in combination with poorly treated diabetes leads to phlegmona and gangrene of the foot. A distinctive ulcus (malum performans) is formed mostly in neuropathic diabetic foot at the points of greatest workload surrounded by hyperkeratosis, which is most often infected. According to Arlt classification, depending on the depth of the ulcus, 4 clinical stages can be distinguished:

1. Superficial ulkus.
2. Ulkus with a depth to the joint capsule and / or tendon.
4. Necrosis and gangrene of the foot.

There are several classifications for describing the lesions of which the most widespread in the world is the so-called Wagner classification for diabetic foot lesions. With its six grades (0 to 5),
it has the advantage that it is easy to use in clinical practice:
Grade 0: no lesion, it is possible plantar deformity or cellulitis
Grade 1: superficial ulceration
Grade 2: deep ulcer reaching the joint capsule, tendons or bones
Grade 3: deep ulcer with formation of an abscess, osteomyelitis and infection of the joint capsule
Grade 4: limited necrosis of the anterior part of the foot or heel
Grade 5: necrosis of the entire foot

**Purpose**
Our purpose is to perform an analysis of the patients treated in the Department of Vascular Surgery (DVS) and to determine the efficiency of the methods that we used for treatment.

**MATERIALS AND METHODS**
Objects of the study are total of 167 patients, 94 men and 73 women who have undergone DVS for a period of two years (2012 – 2013). Local and foreign sources of data on the relevant literature were used for researches, analysis and interpretations of the results. The used techniques were documentary, theoretical, comparative and statistical analyzes.

**RESULTS AND DISCUSSION**
Treated in the ward patients have been sorted by age in Table 1.

![Table 1](image)

<table>
<thead>
<tr>
<th>sex</th>
<th>20-30y.</th>
<th>30-40y.</th>
<th>40-50y.</th>
<th>50-60y.</th>
<th>Over 60y.</th>
</tr>
</thead>
<tbody>
<tr>
<td>male</td>
<td>3</td>
<td>5</td>
<td>22</td>
<td>31</td>
<td>33</td>
</tr>
<tr>
<td>female</td>
<td>1</td>
<td>3</td>
<td>9</td>
<td>29</td>
<td>31</td>
</tr>
</tbody>
</table>

An impression makes the relatively high age of the patients. In addition to diabetes there is also an age induced atherosclerosis of peripheral vessels. We shouldn’t underestimate the presence of concomitant chronic diseases such as coronary artery disease, hypertension, cerebral atherosclerosis, CKD, obese and others, which further aggravates diabetes and its complications.

Essential for the emergence and development of diabetic foot is the limitation period of diabetes mellitus. It had established a direct relation between the limitation period, the beginning of treatment with insulin, poor adjustment to diabetes and occurrence of complications due to the rapidly growing vascular degenerative syndrome. In our patients this is reflected in Table 2.

![Table 2](image)

<table>
<thead>
<tr>
<th>sex</th>
<th>under 5 y.</th>
<th>5-10 y.</th>
<th>over 10 y.</th>
</tr>
</thead>
<tbody>
<tr>
<td>male</td>
<td>11</td>
<td>31</td>
<td>52</td>
</tr>
<tr>
<td>female</td>
<td>8</td>
<td>23</td>
<td>42</td>
</tr>
</tbody>
</table>

All patients included in the study were on insulin correction of blood sugar and when entering treatment in the ward they were in different stage of decompensation of diabetes, in some of them were established ketoacidosis. The late seek for specialized medical care makes an impression.

![Table 3](image)

<table>
<thead>
<tr>
<th>time of hospitalization</th>
<th>under 24 hours</th>
<th>under 5 days</th>
<th>under 10 days</th>
<th>over 10 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of patients</td>
<td>3</td>
<td>34</td>
<td>64</td>
<td>66</td>
</tr>
</tbody>
</table>
The reasons for that may be due to patient’s poor awareness, tendency to self-treatment, and the desire of doctors without adequate qualifications to treat seemingly small sores on the feet. That’s why the treatment of the complications with the infected wound on the diabetic foot can be fatally slowed, and the consequences are most often irreversible - follows a high limb amputation.

Very important for the clinical practice and for the treatment approach is to distinguish the diagnosis of ischemic and neuropathic ulcus. In the neuropathic ischemic diabetic foot, primarily there is no pain, the sensitivity is greatly reduced, the foot is warm, even sore, generally pulsations is found on the foot vessels, the location is on the plantar surface, typical is hyperkeratosis around the ulcer forming a callus. Hypercholesterolemia and hypertension is also established in diabetic ischemic ulcus. Patients are smokers. The ulcer is localized mostly in the fingertips or the heel, painful and very sensitive to touch. There is a shortened intermittent claudication, weakened to missing foot pulsations of the vessels, not detectable callus, the bottom is necrotic with partial granulations. Treatment of diabetic foot is very difficult and slow process. In a stated ischemic diabetic foot revascularizations is taken, aiming to overcome the ischemic component of the disease. They include TEA, femoro-popliteal or femoro-distal by-pass. To the modern methods in this direction belong the so-called hybrid operations – balloon dilatation and putting grafts of the distal segments of the arteries on the lower leg.

The approach is different in the treatment of the infected neuropathic ulcer. The local treatment had an important role. Requires bed rest, ability to relax foot using special orthopedic footwear, surgical treatment of calluses (cut) treatment with different disinfectants and healing ointments (dermazin, yodasept, 5% salicylic ointment, etc.). In the presence of phlegmon, purulent arthritis and osteomyelitis are performed large incisions and counter incisions, excision of necrotic tissue and tendons, debridement, removal of bone with osteomyelitis and drains. Material for microbiological examination is taken. In these cases it is necessary the application of broad-spectrum antibiotics in a combination with metronidazole and requires correction of diabetes. In the presence of hyperbaric chamber is desirable an oxygen therapy, particularly in establishment of anaerobic infection. A simple method is to place the limb in an oxygen tent. Recently, more and more supporters win the method of constant aspiration of the exudation wounds. A special bandage is made that is placed on a vacuum 0.1-0.2 atm.

**Results of treated patients.**

<table>
<thead>
<tr>
<th>operation</th>
<th>Incision</th>
<th>Excision</th>
<th>Debridement</th>
<th>Amputation of one and more fingers</th>
<th>Amputation of foot</th>
<th>Amputation of lower limb</th>
<th>Amputation of hip</th>
</tr>
</thead>
<tbody>
<tr>
<td>sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>31</td>
<td>32</td>
<td></td>
<td>17</td>
<td>3</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>female</td>
<td>15</td>
<td>24</td>
<td></td>
<td>19</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

All of the patients required surgical treatment. In 96 of them a vascular reconstruction had been made on a prior period. The high proportion of amputations (hip and shank) is significant - 29 (17.36% of all patients). From the reconstructed patients only 8 required a high amputation, and the rest had smaller interventions. This suggests that even in advanced cases of Neuro – Ischemic diabetic we shouldn’t give up on Vascular Reconstruction.

**CONCLUSION**

In conclusion, based on the findings and analysis, we can deduce the following findings and recommendations:
- Diabetic foot is a leading social - significant disease.
- The problem of diabetic foot is to be treated as a separate complex of symptoms, and not just as a complication of diabetes.
- Early diagnosis, early treatment and proper prevention are key to avoiding complications and ensuring a better quality of life in patients with diabetes.