CASE REPORT

Particularities of Surgical Treatment for the Neuropathic Diabetic Foot

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Abstract

Diabetic neuropathy is one of the chronic complications of diabetes and along with other complications causes a pathology called diabetic foot. The present study analyzed a group of 164 patients admitted to the surgery department of the Clinical Hospital "Doctor Ioan Cantacuzino" Bucharest, between September and December 2019. The results of the study highlight the potential for contamination of neuropathic lesions and the need for curative surgery, most conservative. The conclusion of the analysis emphasizes that the imbalance of the underlying disease changes, in a negative sense, the prognosis of any complication of it.

Keywords: diabetes mellitus, diabetic foot, neuropathy, personalized, complication.

Rezumat

Neuropatia diabetică este una dintre complicațiile cronice ale diabetului zaharat și împreună cu alte complicații determină patologia numită picior diabetic. În studiul de față s-a analizat un lot de 164 de pacienți internați pe secția de chirurgie a Spitalului Clinic „Dr. Ioan Cantacuzino” București, în perioada septembrie – decembrie 2019. Rezultatele studiului subliniază potențialul de contaminare al leziunilor neuropate și necesitatea intervențiilor chirurgicale curative, majoritatea conservatoare. Concluzia analizei subliniază faptul că dezechilibrul bolii de bază modifică, în sens negativ, prognosticul oricărei complicații ale acesteia.

Cuvinte cheie: diabet zaharat, picior diabetic, neuropatie, personalizat, complicație.

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INTRODUCTION

Diabetes causes changes that affect the vessels, nerves and soft tissues of the lower limb, changes that have been attributed to the notion of „diabetic foot”. Surgical complications of the diabetic foot are represented by diabetic angiopathy and diabetic neuropathy, encountered simultaneously, with the predominance of one of them. The most common form is neuropathy, the advantage being the low rates of major amputations and mortality compared to ischemic lesions^{1,2}.

Diabetic neuropathy is the most common and early chronic complication of diabetes and was defined by Boulet as: “any damage to the peripheral, central, somatic and vegetative nervous system that is clinically detectable and without obvious etiology other than diabetes.”. The diagnosis of diabetic neuropathy is based on the association of clinical signs with altered functional neurological tests on two or more nerves, but is established late in the onset of pain and trophic changes³. The frequency of diabetic neuropathy increases with the age of the patient and the age of the underlying disease⁴. The most common location of diabetic neuropathy is in the lower limbs, characterized by bilateral, symmetrical and predominantly sensitive^{5,6}. Sensitive disorders are described by the patient as pain (intense / deaf / stabbing, in the form of nocturnal paroxysms, with relief while walking) or paresthesia (numbness, coldness, burning, distally charged to the lower limbs)⁴. In the evolution of the disease, the small sensitive nerve fibers determine the decrease of nociceptive sensitivity until anesthesia, but also of thermal sensitivity with the possibility of burns, frostbite, stinging or cut wounds not noticed by the patient^{4,7,8}. There are also deep sensitivity disorders with hypo- or areflexion, but also myo-arthro-kinetic disorders with altered balance, decreased proprioceptive and vibratory sensitivity^{4,9,10}. Motor neuropathy represented by plegia or paresis is less common in diabetic patients, but amyotrophic manifestations may occur¹¹. Diabetic osteoarthropathy occurs because of neuropathy, the bone and joint lesions being characteristic of the distal tarsus-metatarsal, metatarsophalangeal and tibio-talar joints and resulting in a significant change in the foot, which becomes flat, shorter, thicker, with a tendency to eversion and external rotation⁴.

The treatment of diabetic neuropathic foot is carried out on 3 levels: prophylaxis, conservative surgical treatment and radical surgical treatment, minor and major amputations (calf and thigh). Prophylaxis in the occur-

rence of ulcers is represented by special footwear that achieves an equal distribution of plantar pressure, decreases the stress under the ends of the metatarsals and reduces the impact of shocks while walking, produced predominantly by body weight. Conservative surgical treatment refers both to incision, debridement or fasciectomy, small-scale, non-disabling surgery; as well as the use of topical treatments such as hyaluronate, alginate, hydrogels for neuropathic ulcers, absorbent dressing^{3,12,13}. Minor amputations (phalanx resection, finger disarticulation and transmetatarsal amputation) are well tolerated by patients, the functionality of the operated lower limb being affected to a small extent, and minimal prosthesis is easily achievable¹⁴. Regarding major amputations, calf amputations have a major advantage compared to thigh amputations, by preserving the knee joint, which ensures a high degree of postoperative recovery of limb function by prosthesis. Regardless of the type of surgical treatment, it is necessary to combine antibiotic therapy, initially empirical, with a broad spectrum, then in accordance with the antibiogram after harvesting biological products from the wound.

MATERIAL AND METHODS

The present study is an observational retrospective analysis that includes a retrospective observational study on 164 patients admitted to the surgery department of the Clinical Hospital „Dr. Ion Cantacuzino”, Bucharest, between September and December 2019. In addition to typical demographic parameters, the study also follows specific parameters, regarding paraclinical details, the type of surgery, the associated antibiotic therapy and the postoperative complications.

RESULTS

Demographic data

As a distribution by section, the predominance among males is 84% compared to 16% among females.

In the studied group, the age range 60-69 years is the best represented, totaling 66 patients out of a total of 164, followed by the age ranges 70-79 years, respectively 50-59 years with approximately equal distribution. The average age was 63 years, with heads ranging from 35 to 90 years, respectively.

Paraclinical data

From the group of 164 patients: 88 patients had leukocytosis (WBC value greater than $10.00 \cdot 10^3 / \mu\text{L}$),

87 had anemia (HGB value less than 12g / dL), 52 had elevated serum urea and serum creatinine (urea value is greater than 50 mg / dL, and creatinine value is greater than 1.2 mg / dL). At the time of admission, 113 patients had serum blood glucose values collected higher than 126 mg / dL, which demonstrates poor control of diabetes and accelerated complications.

Hospitalization diagnosis, types and location of lesions

The most common diagnosis at hospitalization, found in 76 of the subjects, is wet gangrene (neuropathic, microangiopathic involvement and bacterial infection) (Figure 1), 28 were identified with osteitis and 25 with osteoarthritis (Figure 2), 19 subjects presented with hospitalization ulceration (soft tissue involvement), 14 had superinfected wounds (Figure 3), 7 patients had phlegmons and 4 patients presented with Charcot foot (Figure 4), respectively plantar perforating shore. Out of a total, 13 subjects had double diagnoses, associating osteostructural changes with infectious processes.

Figure 2. Osteitis lesion

Figure 1. Extensive wet gangrene of the toe

Figure 3. Toe ulceration

Figure 4. Charcot foot

Regarding the location of the lesions, the majority (105 patients) are located at the level of the fingers, followed by plantar and calcaneal lesions.

Types of surgery

Regarding the surgical interventions, there is a tendency to use conservative treatments (incisions, debridements, ray resections). The most common therapeutic intervention, performed in a number of 70 patients, is the transmetatarsal amputation of the toe (ray resection): 65 benefited from limited interventions (incisions, debridements); 27 major amputations, 22 of the calf and 5 of the thighs. 40 of the patients needed successive interventions during hospitalization.

Antibiotic therapy

Out of the group of 164 patients, only 10 patients did not require antibiotic treatment, the rest benefiting from monotherapy as follows: 109 cases treated with cephalosporins, 7 cases with fluoroquinolones, 5 cases with carbapenems, 4 cases with glycopeptides and 2 cases with lincosamides.

DISCUSSION

The appearance of chronic neuropathic changes is due to imbalances and poor control of the underlying disease. By associating with other chronic complications,

it modifies the vital prognosis and the quality of life, reaching the locomotor disability through the evolution of the disease or through the radical surgical treatments.

Due to the location of the lesions, they go unnoticed by the patient until the onset of local or extensive pain and / or infection, as evidenced by the values of leukocytes at admission, the isolation of outbreaks and the need for antibiotic therapy to resolve the case. Commonly identified germs include: *Pseudomonas aeruginosa*, *Enterobacter*, *Staphylococcus aureus* or Group B beta-hemolytic streptococcus.

The interventions performed in most cases were conservative since the microangiopathic involvement among these patients is incipient. Cases with serial interventions demonstrate the lingering nature of infections of the diabetic foot patient and the need to achieve extensive debridement to healthy tissue.

CONCLUSION

Diabetic neuropathy is an early and common complication of any type of diabetes and can be prevented or slowed down by a good medical education of patients, skillfully led by a multidisciplinary team that knows the pathophysiological mechanisms of the underlying disease.

The neuropathic diabetic foot surgical treatment is most commonly represented by minor amputations, the real success is achieved by following the diabetes mellitus treatment, correct wound dressing, targeted antibiotic therapy associated with the surgical procedure.

Compliance with ethics requirements: The authors declare no conflict of interest regarding this article. The authors declare that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law. Informed consent was obtained from all the patients included in the study.

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