

# Conservative treatment of diabetic foot infections

## Trattamento conservativo delle infezioni del piede diabetico

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### INTRODUCTION

15% of diabetics have foot wounds during their life-time while 20 percent of the diabetic patients who are admitted to hospitals are admitted for foot problems [1, 2]. The cause of damage in the diabetic foot can be conveniently divided into three categories: ischemia, soft tissue neuropathic changes and neuropathic arthropathy [3]. Although these disorders may be accompanied by infection secondarily, in rare conditions the infection may be seen as a primary event [3]. Based on clinical, roentgenographic, surgical

and histopathologic findings, infections were classified as to the presence of cellulitis, osteomyelitis, and soft tissue necrosis as necrotizing fasciitis [4, 5]. These ulcerated lesions of diabetic foot are graded to determine the prognosis and therapeutic choices. For grade 0 the skin is intact, for grade 1 there is a superficial ulceration on skin and subcutaneous tissue. In grade 2 the ulceration reaches tendons and bone. In grade 3 there is abscess and osteomyelitis. In grade 4 there is necrosis on the thumb and distal foot and in grade 5 there is necrosis on the heel and mid foot [6, 7].

Table 1 - Cases with Diabetic Foot

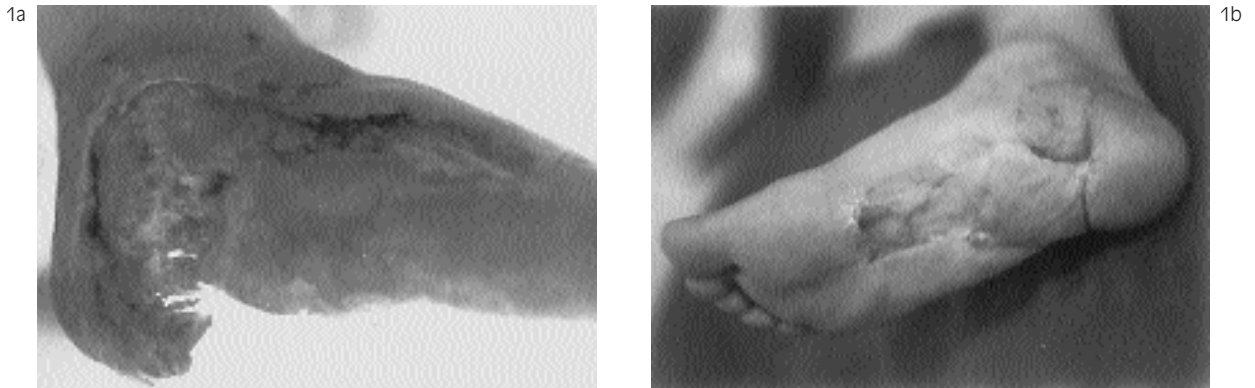
Case	Age sex (*)	Duration of diabetes	Place	Grade	Peripheric neuropathy	Peripheric pulse	Cultures	Number of	Reconstruction Debridments
1.	56 F	0	heel	5	-	+	Klebsiella spp.	3 times	Medial plantar flap
2.	66 M	15	dorsal	3	-	+	-	1 times	Skin graft
3.	58 M	25	dorsal	3	-	+	-	1 times	Skin graft
4.	64 F	25	plantar	4	+	-	Bacteroides spp	2 times	Skin graft
5.	46 M	14	plantar	2	+	+	Pseudomonas spp	3 times	Skin graft
6.	54 F	10	plantar	4	+	-	Staph. aureus	3 times	Skin graft
7.	72 M	13	plantar	2	+	-	-	1 times	Skin graft
8.	68 M	20	heel	5	+	+	Pseudomonas spp	2 times	Medial Plantar flap
9.	48 M	24	plantar	5	+	-	Staph. aureus	2 times	Amputation
10.	22 M	13	plantar	3	-	-	Streptococcus spp	1 times	Skin graft
11.	73 M	42	dorsal	2	+	-	-	1 times	Skin graft
12.	54 M	13	plantar	2	-	+	-	1 times	Skin graft
13.	65 M	20	plantar	4	-	+	Pseudomonas spp.	1 times	Skin graft

\*F: female, M: male

## ■ CASES

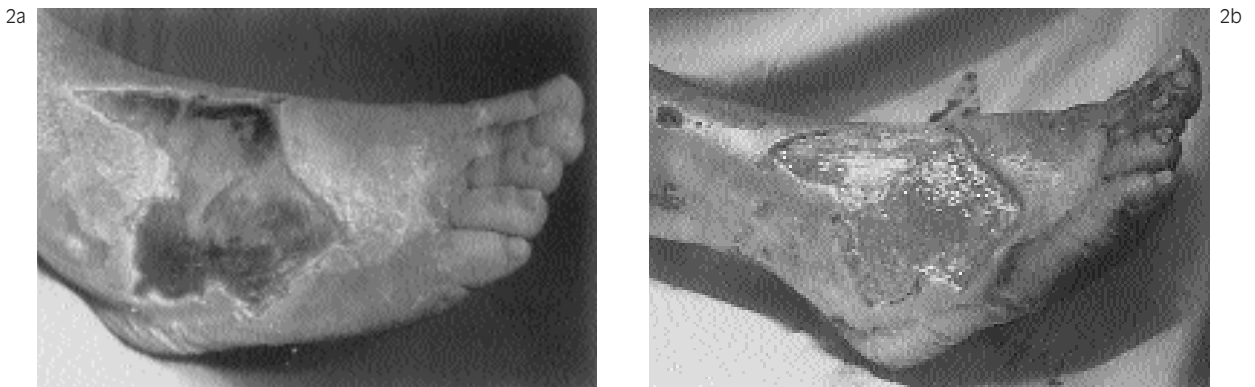
During the last two-years period, 13 diabetic foot infections were evaluated using multidisciplinary approach at Pamukkale University Faculty of Medicine, Department of Plastic and Reconstructive Surgery, Department of Clinical Mi-

crobiology and Infectious Diseases, Department of Internal Medicine Division of Endocrinology (Table 1). Six of the cases were grades 4 and 5, and the type of infection was clinically necrotising fasciitis (Figure 1). Three of them were grade 3 (Figure 2) and the other four were grade 2 diabetic foot ulceration. All of the patients were



**Figure 1** - Grade 5 diabetic foot ulceration of case 1 with necrosis of the heel and mid plantar area.

- a) Soon after debridment, fascia necrosis appeared
- b) After the defect was reconstructed by medial plantar flap and skin grafts.



**Figure 2** - Grade 3 diabetic foot ulceration of case 2

- a) With skin necrosis at the dorsum of the foot
- b) After debridment and defect was granulated
- c) After the defect was reconstructed by skin graft.



monitored by daily wound care, aggressive surgical approach, intensive regulation of blood glucose levels and administration of broad spectrum antibiotics. Sulbactam-ampicillin was the first choice of antibiotics in empiric treatment of these infections. Then, according to the microorganisms which were isolated from the infectious materials and to the results of antibiograms, the antibiotic regimen was evaluated. Only one of the patients required amputation as blood glucose levels and infectious fever could not be controlled. For 12 of the cases after the infection was controlled, the defects were reconstructed by plastic surgical procedures. The following time ranged from 6 to 23 months, with a mean of 8 months. We retrospectively analyzed the patients to review diabetic foot infections and factors affecting prognosis.

## ■ DISCUSSION

The existence of peripheral neuropathy, osteomyelitis and impairment of vascular index are the main prognostic factors in diabetic foot infections. Impairment of sensory, motor and autonomic nerve function is the primary factor responsible for foot ulceration in diabetic patients. Autonomic nerve dysfunction leads to anhidrosis and hyperkeratosis of plantar foot skin, resulting in fissuring which is probably the main gateway for bacterial entry and contributes to infection. Absent sensation between the toes and over bony prominences causes a delay in the detection of small breaks in the skin or new blisters. Motor neuropathy leads to the paralysis and eventual fibrosis of the intrinsic foot musculature in a manner similar to the way that ulnar dysfunction causes claw deformity. These deformities are associated with the development of ligamentous soft tissue changes with accompanying synovitis and soft tissue changes [1]. In diabetic patients arteriosclerosis is accelerated and they are prone to small vessel diseases such as diabetic microangiopathies.

Diminished vascular blood flow is an important measure in detecting poor prognosis. The ratio between the ankle blood pressure and brachial blood pressure is known as the vascular index. If the normal index of 1.0 to 1.1 is reduced to values of 0.3 or lower, this indicates patients with nonhealing wounds. For patients with grade 1 and grade 2 foot ulcerations with a vascular index over 0.45, recovery is possible through conservative treatment [1, 6, 7]. Although these types of low grade cases have good prognosis, most diabetic feet have osteomyelitis and soft tissue infections and they are high grade. Eight of the presented patients belonged to this group. Although for this group of patients with 50-70% amputation rate it is difficult to save the extremity, we successfully managed these difficult wounds and 7 of them healed without major amputation. Today, with aggressive surgical debridments and use of reconstructive procedures of plastic and reconstructive surgery, the amputation rate has decreased to 5% in this life and limb threatening infection [1].

By intensive regulation of blood glucose levels and use of appropriate antibiotics, these patients can be followed conservatively and can be prepared for reconstruction [8]. The usage of very simple techniques is advised to salvage diabetic feet. As skin grafts are suitable choices for the dorsal surface of foot and plantar nonweight-bearing surfaces, local skin flaps, fasciocutaneous flaps, muscular flaps with skin flaps and free flaps are suitable choices for ulcers on weight-bearing parts of the foot such as metatarsal heads and the heel [1, 5, 9]. By using proper reconstruction techniques stable results can be achieved. We used medial plantar flaps for two of our patients for hind foot reconstruction and other dorsal and plantar ulcerations were reconstructed by skin grafts. Our patients were followed for 6 to 23 months, with a mean following time of 8 months. In none of the patients have we seen any recurrence of foot problems so far.

*Key words:* diabetic foot

## SUMMARY

Foot infections commonly occur in diabetic patients, constituting a serious problem. 15% of diabetics have foot infections during their life-time. In previous years these life-threatening infections in 50-70% of patients resulted in limb amputation. Today, using an aggressive surgical approach, broad spectrum antimicrobial chemotherapy and intensive regulation of blood glucose level, the amputation rate has decreased to 5%. During the last 2 years, we evaluated 13 diabetic foot infections. 6 of the presented cases were grade 4 and 5, 3 of them were grade 3 and 4 of them

grade 2. All of the patients were managed by multidisciplinary approach consisting of plastic and reconstructive surgery, endocrinology and infectious diseases specialists. All of the patients were monitored with daily wound care, regulation of blood glucose levels and administration of broad spectrum antibiotics. Only one of them required amputation. For 12 of the cases after the infection was controlled, the defects were reconstructed by plastic surgical procedures. We retrospectively analyzed them to review diabetic foot infections and factors affecting prognosis.

## RIASSUNTO

*Nel paziente diabetico le infezioni localizzate al piede costituiscono un problema serio oltre che di frequente riscontro. Nel corso della propria vita il 15% dei diabetici va incontro a tale tipo di infezione. In passato tali infezioni, che mettono in serio pericolo la vita stessa del paziente, si traducevano nel 50-70% dei casi nell'amputazione dell'arto. L'attuale approccio chirurgico aggressivo, l'impiego di una terapia antibiotica a largo spettro d'azione e il controllo sistematico ed intensivo dei livelli ematici di glucosio hanno consentito di poter ridurre il tasso di amputazioni al 5%. Nel corso degli ultimi due anni abbiamo valutato 13 casi di infezioni del piede diabetico. Sei di essi erano di grado 4 e 5, tre erano di grado 3 e quattro di gra-*

*do 2. Per tutti i pazienti si è ricorso ad un approccio multidisciplinare che ha richiesto l'intervento congiunto del chirurgo plastico, dell'endocrinologo e dell'infettivologo. Il controllo quotidiano della ferita, nonché la regolazione della glicemia e la somministrazione di un antibiotico a largo spettro è stato eseguito per tutti i pazienti. L'amputazione dell'arto si è resa necessaria solo per un paziente. Per gli altri 12 pazienti, successivamente alla guarigione dell'infezione, si è proceduto ad interventi di chirurgia ricostruttiva. Gli autori hanno quindi analizzato retrospettivamente tali pazienti al fine di rivedere le infezioni del piede diabetico e i fattori correlati che ne hanno influenzato la prognosi.*

## REFERENCES

- [1] Cohen L.B. The diabetic foot. In: *Mystery of Plastic and Reconstructive Surgery*. Cohen M. (Ed.) Little Brown and Company, USA, Volume 3, pp. 1839-1859, 1994.
- [2] Akova M., Özcebe O., Güllü I., Ünal S., Gür D., Aklin S., Tokgözoğlu M., et al. Efficacy of Sulbactam-Ampicilin for the treatment of severe diabetic foot infections. *J. Chemother.* 8, 248-289, 1996.
- [3] Harrelson J.M. Management of diabetic foot. *Orthop. Clin. North. Am.* 20, 605-619, 1989.
- [4] Wheat L.J., Allen S.D., Marietta H., Kernek C.B., Siders J.A., Kuebler T., Finenberg N., et al. Diabetic foot infections: Bacteriologic Analysis. *Arch. Intern. Med.* 146, 1935-1940, 1986.
- [5] Gökalan I., Yalçın N., Sermez Y., Yılmaz M. Type I necrotising fasciitis of heel in a diabetic patient. *Le Infezioni in Medicina*, 1, 48-53, 1998.
- [6] Wagner F.W. The diabetic foot. *Orthopedics* 10, 163-172, 1987.
- [7] Wagner F.W. Surgery of the diabetic foot. *Surgery of the Musculoskeletal System* 9, 203-230, 1983.
- [8] Serdaroglu I., Özgentas H.E. Diyabetik ayak tedavisinde konservatif yaklasimimiz. XIX Ulusa Plastik ve Rekonstruktif Cerrahi Kongresi, Bildiri Özetleri, No: 160, 1997.
- [9] Topalan M., Çerkes N., Aydın A., Özkan T., Baktiroglu S., Erer M. Diyabetik hastalarda serbest flep uygulaması ile alt ekstremité kurtarılması. XIX Ulusal Plastik ve Rekonstruktif Cerrahi Kongresi, Bildiri Özetleri, No: 8, 1997.