

Rescue of diabetic foot from amputation – a case report

Ratowanie stopy cukrzycowej przed amputacją – opis przypadku

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ABSTRACT

This study presents the case of a 52-year-old man with a 15-year history of insulin-dependent diabetes, who developed phlegmon of his right foot following an attempt to remove a corn. On admission, the patient presented symptoms of incipient sepsis. The treatment – wide incisions on the foot, evacuation of collected pus and necrotic debris, as well as antibiotic therapy – allowed for stabilization of the patient's general condition. However, the local infection of the foot did not withdraw and the patient required repeated surgeries, including amputation of the toes and metatarsal bones. The infection progressed, spreading to the lateral

ankle and the distal part of the calf. During the next operation, following incision and drainage of pus, the substance Stimulan, which aids in the liberation of antibiotics, was introduced to the wounds; this appeared to be effective and resulted in control of the infection. Soft tissue defects were repaired by local flap-plasty and split skin grafting. At the follow-up examination 6 months later, the patient displayed completely healed wounds, wore normal shoe on the affected foot, and walked without any support.

Keywords: diabetes complications; diabetic foot ulcer; diabetic foot infection; amputation risk.

ABSTRAKT

Przedstawiono przypadek 52-letniego mężczyzny, chorującego od 15 lat na cukrzycę insulinozależną, u którego rozwinęła się ropowica prawej stopy po próbie usunięcia odcisku. W momencie przyjęcia pacjent miał objawy rozpoczynającej się posocznicy. Zastosowane leczenie – szerokie nacięcia na stopie, ewakuacja zbiorników ropy, martwych tkanek i antybiotykoterapia – pozwoliło na opanowanie zakażenia ogólnego, jednak infekcja na stopie nie ustępowała, a pacjent wymagał kolejnych operacji i amputacji palców oraz kości śródstopia. Zakażenie rozszerzało się, obejmując okolicę kostki bocznej i dalszy odcinek podudzia.

W czasie kolejnej operacji, po nacięciu i drenażu zbiorników ropy, wprowadzono do ran preparat Stimulan, uwalniający antybiotyki, co okazało się skuteczne i pozwoliło na opanowanie zakażenia. Ubytki tkanek zamknięto plastyką płatową skóry i przeszczepami pośredniej grubości. W badaniu kontrolnym po 6 miesiącach od zakończenia leczenia pacjent miał całkowicie zagojone rany, zakładał na okaleczoną stopę normalne obuwie i chodził swobodnie.

Słowa kluczowe: cukrzyca powikłania; owrzodzenie stopy cukrzycowej; zakażenie stopy cukrzycowej; ryzyko amputacji.

INTRODUCTION

The incidence of diabetes in the general population is systematically increasing and, in spite of effective treatment, the number of complications increases, too. One of the more common complications is the development of ulcerations and infection within the foot, colloquially called “diabetic foot”. It is usually associated with ineffective treatment of diabetes, in terms of uncontrolled high blood glucose levels, which furthers development of diabetic angiopathy and infections. Angiopathy and subsequent ischaemia of the soft tissue of the foot may also occur, although less frequently, in patients with correctly and systematically treated diabetes. Ulcerations and infections are frequently caused by neglect of foot hygiene and wearing tight, uncomfortable footwear. Development of these complications is facilitated by impaired sensitivity within the feet due to diabetic neuropathy, which reduces feelings of pain associated

with ulcerations and infections. Management of these pathologies is long-term and relatively difficult, requiring patience on the part of the physician and compliance of the patient. In spite of the use of modern therapies, i.e. vacuum drainage or hyperbaric oxygen chambers, the rate of amputation for diabetic foot remains high, reaching 15–30% [1, 2, 3].

This paper presents the case of a patient with a 15-year history of insulin-dependent diabetes who suffered from severe phlegmon of his right foot. The treatment employed with this patient was eventually successful – the foot was saved, although some of the toes had to be amputated.

CASE REPORT

A 52 year-old male patient with a 15-year history of insulin-dependent diabetes, suffering from severe phlegmon of his

right foot was admitted to the Department of General and Hand Surgery at Pomeranian Medical University in Szczecin. Three weeks prior the patient had attempted to remove a corn from the plantar aspect of his foot, which resulted in the development of infection and a chronic wound. Two days prior to admission, the pain in his foot exacerbated significantly, followed by an inability to bear weight on the foot, fever over 39°C and chills. Upon admission, a deep ulceration was seen on the plantar aspect of the right foot, discharging a turbid fluid. The whole foot and distal part of the lower leg were swollen, warm, red-coloured and crepitation was felt upon palpation of soft tissue, suggesting presence of gas bubbles. Pulsation of the dorsalis pedis artery was not detectable and the II–IV toes were cyanotic (Fig. 1). The patient had significantly reduced sensation in the affected foot, most likely due to diabetic neuropathy.

Biochemical tests revealed significantly elevated inflammatory parameters: leukocyte count – 15 G/L, CRP concentration – 353 mg/dL, and procalcitonin – 7.7 µg/L, suggesting the development of sepsis. Glucose concentration in blood was 307 mg/dL and in urine 800 mg/dL. Kidney biochemical parameters were also elevated, including urea concentration of 78 mg/dL and creatinine – 21 mg/dL, suggesting incipient renal failure. Considering the patient's clinical status and the results of biochemical tests, intensive treatment was commenced, including glucose control by intravenous insulin, renal function improvement, and broad spectrum antibiotic infusion – amoxicillin with clavulanic acid and metronidazol. A decision was made to perform rapid surgical intervention.

COURSE OF THE TREATMENT

The operation was performed under epidural anaesthesia. Skin and subcutaneous tissue on the plantar and dorsal aspects of the midfoot was widely incised followed by evacuation of pus deposits and necrotic debris (Fig. 1 and 2). Necrotic plantar aponeurosis was excised. After debridement, the wounds

were irrigated with disinfecting fluid and drains were placed in the wounds. Postoperative course was uneventful in regards to the general status of the patient: fever subsided, glucose levels returned to normal and renal function improved. Procalcitonin concentration diminished to <0.5 µg/L, but CRP remained elevated >300 mg/dL. Antithrombotic therapy was introduced by subcutaneous injections of dalteparin 1 × 40 mg/day. Three days after surgery the results of bacteriological culture tests were obtained, showing infection by *Citrobacter coseri*, which was resistant to amoxicillin. Antibiotic therapy was changed to ciprofloxacin 3 × 0.2 g i.v., with continuation of metronidazol treatment.

Contrary to improvement of the general condition of the patient, local status of the foot gradually deteriorated, despite daily debridement and use of wet antiseptic dressings. Leakage of purulent fluid from the wounds persisted and II–IV toes became more ischemic. A skin defect of 10 × 5 cm size developed on the forefoot and an X-ray showed osteomyelitic changes in the metatarsal bones and phalanges. The toes became visibly necrotic 10 days following the 1st operation; therefore, the decision was made to amputate them after obtaining informed consent from the patient. A 2nd operation was performed under epidural anaesthesia. Intraoperatively, apart from necrosis of II–IV toes, osteomyelitis of distal portions of the metatarsal bones and infected necrosis within the soft tissue of the midfoot was noted. The affected toes were amputated followed by excessive resection of all infected soft tissues. The wound was partially closed using a skin flap obtained after “filleting” of the skin from amputated toes; drains were placed in the wounds.

Results of bacterial culture of the material taken during the 2nd surgery showed the presence of *Fusobacterium nucleatum* and *Enterobacter cloacae*; after consultation with the Department of Infections at the hospital, therapy with Bisseptol 2 × 960 mg i.v./day and metronidazol 3 × 0.5 g/day was introduced. In spite of this targeted antibacterial therapy, the local status of the foot did not improve and a few days after the 2nd operation



FIGURE 1. Appearance of the foot 3 days after incision of the phlegmon on the dorsal aspect. Note a cyanotic discoloration of the II–IV toes



FIGURE 2. Appearance of the foot 3 days after excision of the corn and incision of the phlegmon on the plantar side



FIGURE 3. Intraoperative view during 3rd operation showing incisions of pus deposits at the lateral ankle and on the lower leg; balls of Stimulan are visible in the wound



FIGURE 4. Appearance of the patient's foot at discharge



FIGURE 5. Appearance of the patient's foot at 6 months post-op

redness and painful swelling was observed in the distal portion of the lower leg and around the lateral ankle, suggesting progression (ascending) of the infection. The decision was made to perform another operation, in which the skin over the site of infection was incised followed by evacuation of pus deposits and tissue debris (Fig. 3). The old wounds on the forefoot were also debrided of residual necrosis. Regarding the relatively week response to intravenous antibiotics, local supportive therapy was introduced by placement of antibiotic-coated (vancomycin and gentamycin) balls (Stimulan) into the wounds on the forefoot and lateral ankle (Fig. 3). This substance is used for local treatment of bone and soft tissue infections; it has properties that allow it to fill the empty space after resection of infected tissues and to slowly release antibiotics into the adjacent tissues. The balls can be coated with several antibiotics, depending on the species of organisms cultured.

After the 3rd intervention, local status of the foot improved: pus drainage from the wounds gradually diminished, allowing them to be left "open", without dressings. At 2 weeks, the local status was sufficiently good to attempt to cover the defect on the forefoot with a split skin graft. This eventually resulted in healing of the wounds (Fig. 4). The patient, walking with the support of one crutch, was released home 6 weeks after admission. At the 6-month follow-up, the patient presented with all wounds in the right foot completely healed; he wore standard shoes on his feet, walked without any restrictions and returned to previously performed work (Fig. 5).

DISCUSSION

The presented case is an example of successful prevention of amputation of a neglected diabetic foot. Upon admission, the patient was seriously ill, with uncontrolled diabetes, incipient sepsis and renal failure. The promptly commenced treatment appeared to be effective, as rapid improvement of the general condition was observed, but without adequate local response of the infected foot. Antibiotic therapy, although targeted at cultured organisms, failed to control the infection and the development of soft tissue and bone necrosis. One may suppose that this was caused by the ischaemic component of the disease (diabetic angiopathy), as pulsation of the dorsalis pedis artery was not detectable. Sensory disturbances in the foot suggested additional diabetic neuropathy. Both these signs are typical of long-lasting and likely inadequately managed diabetes. It appears that placement of antibiotic-coated balls which slowly release 2 antibiotics directly into the wounds allowed the infection within the foot and lower leg to be controlled. The organism cultured from the pus (*Citrobacter coseri*) is a Gram (-) bacillus, belonging to the big Enterobacteriace family. It is an opportunistic organism presenting naturally in the large bowel and causing the most frequent urinary tract infections. Subsequent cultures revealed the presence of superinfection by other bacteria: *Fusobacterium nucleatum* and *Enterobacter cloacae*, which are typically found in diabetic feet and required a change of the primarily used antibiotics.

It is worth mentioning that, in cases with a lack of rapid response to the commenced treatment, the risk of development of florid, life-threatening sepsis is relatively high. In such an unfavourable scenario, a prompt amputation of the affected foot would be an absolute, life-saving solution. Delayed amputation of a foot affected with phlegmon and necrotizing fasciitis can have fatal consequences, which is supported by numerous examples from the literature [4, 5, 6].

Literature provides many descriptions of successful treatment of neglected diabetic feet and avoidance of amputations. If amputation of the ischemic lower limb due to advanced arteriosclerosis is frequently inevitable, the diabetic foot can, and should be saved. The treatment employed in the presented case was standard, except for the implantation of slow-release antibiotic-coated balls in the affected tissue. Other possible therapeutic options include vacuum drainage or hyperbaric oxygen therapy [2]. The former method is currently standard in the management of excessive and poorly healing wounds, as well as digestive tract fistulas. Vacuum drainage therapy may be used in an outpatient setting, which significantly reduces overall treatment costs. Hyperbaric chambers are less widely available and only a few hospitals in Poland are equipped with them. However, even the use of these advanced techniques cannot always prevent amputation of the foot in severely neglected cases.

The presented case, in which the infected diabetic foot was saved and amputation avoided in a middle age and

professionally active patient, may not be exceptional, but – in our opinion – is worth presenting due to the effectively overcome obstacles which the authors faced. Although the final result was imperfect and the foot was injured, it was saved sufficiently to allow the patient to walk normally and return to previously performed work, which can be considered an indisputable success.

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