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Original Research Article

A Retrospective Study to Evaluate the Surgical and Pharmaceutical Management of Diabetic Foot Infection

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Abstract

Background: With expensive medical care and lengthy hospital stays, diabetic foot infection is a leading cause of patient disability and decreases the need for limb amputations.

Aim: The purpose of this study was to assess the effectiveness of surgical wound care combined with antibiotics in the management of mild and moderate diabetic foot infections.

Methods: 60 individuals with diabetic foot infections, either with or without osteomyelitis, participated in this retrospective analysis. The patients were divided into groups 1 and 2, mild and moderate, respectively. Local wound debridement and systemic antibiotic treatment were used to treat both groups. Patients in Group 1 (16) received treatment with two oral antibiotic regimens for 10–14 days each: regimens A (amoxicillin/clavulanate + metronidazole) and B (clindamycin + metronidazole). A (ampicillin + cloxacillin + metronidazole) and B (lincomycin + metronidazole) were the two regimens used to treat the 42 patients in Group 2 for a total of six weeks. Three months of patient follow-up with neighbourhood wound care experts allowed for evaluation of the effectiveness of the therapy (cure, improvement, or failure).

Results: Group 1 had a cure rate of 80% with regimen A and a cure rate of 100% with regimen B. Patients in group 2 receiving regimen A had a 61.5% cure rate and improved by 11.53%, whereas those receiving regimen B had a 68.75% cure rate and improved by 12.5%. In 20 osteomyelitis patients treated with both regimens, failure was 23.8%; over the trial period, cure rates were 35% and improvement rates were 20%.

Conclusion: Local surgical wound treatment for three months followed by six weeks of antibiotic regimens produced good cure rates, lower expenditures, and fewer hospitalizations. For mild diabetic foot infections, intravenous lincomycin and oral metronidazole had better cure responses.

Keywords: Outpatients, Diabetic foot, Antibiotics, Infection

Introduction

A significant consequence of diabetes mellitus that can result in morbidity and disability is diabetic foot infection. If left untreated, it can be fatal, necessitating lower limb amputation, and may result in systemic infection and septicemia [1, 2]. It is very expensive to treat.

According to international studies, 25–50% of diabetes patients require amputations because of infections. Diabetic foot infections are linked to an increased yearly risk of hospital admission and referral in the United States [3, 4].

The detrimental effects of diabetic foot infections on patients' life are highlighted in reports. Diabetes mellitus's negative effects on the peripheral nerve system, which result in motor, sensory, and autonomic neuropathy, stress shear, foot deformity, dryness, and peripheral artery atherosclerosis, are the cause of diabetic foot infections [5]. Due to slight trauma, all these variables increase the risk of foot ulcers. Although recurring ulceration and infection are possible, treating diabetic foot ulcers is essential for preventing infection. Depending on the categorization and bone involvement, diabetic foot infection is treated differently. Although local wound care, surgical debridement, dressing changes, and pharmaceutical therapy all have a role in outcomes [6].

Successful care starts with a thorough assessment of the patient's medical history, current health, wound depth, and infectious microorganisms. To determine the best antibiotic therapy and prevent infection of nearby tissue in instances of mild wound infection, it's vital to check the depth of the wound, drain any abscesses, assess the microcirculation, and do culture sensitivity tests [7,8]. In addition to lengthy regimens of antibiotic therapy, moderate and severe diabetic foot infections necessitate more rigorous surgical wound debridement, drainage of abscesses, and in certain circumstances, minor or major amputations [9,10].

The right antibiotic selection is crucial to protect against all of the relevant bacteria. The commonly isolated S. aureus and streptococci species should be susceptible to the antibiotics' effects [11]. Different recommendations are available for choosing antibiotics, and there are no set durations, delivery methods, or superior regimens. Each approach, however, is based on the level of illness, the isolated microorganisms, and the history of prior antibiotic use [12, 13], and [14].

The current study's objective was to assess how surgical wound care and antibiotic administration compared to the severity of the diabetic foot infection cases.

Methodology

In order to assess the surgical and antibiotic care provided to patients who presented to an orthopaedic consultation clinic between October 2015 and November 2016 with diabetic foot infections of mild to moderate severity as determined by the IDSA classification (Table 1), we conducted a retrospective clinical study [2].

Table 1: Diabetic foot infection severity according to IDSA classification

Clinical description	Severity
Purulence or erythema, discomfort, tenderness, warmth, or induration are signs of inflammation. Cellulitis or erythema that spreads more than 2 cm around the ulcer is restricted to the skin or superficial subcutaneous tissues. There are no systemic diseases or local consequences.	Mild
infection in a patient who is metabolically stable and in good health overall but has less than 2 cm; lymphangitis, spread beneath the fascia, deep tissue abscess, gangrene, and involvement of the muscles, tendons, joints, or bones	Moderate

infection in a patient who is toxic or has unstable metabolism.	Sever

Patients

The present study included a total of 60 patients. General information, a history of diabetes mellitus, a history of diabetic foot infection, a history of prior amputation, current antibiotic therapy, and drugs were all noted in their clinical data.

General examination, vital signs, local examination of both feet, including neurovascular evaluation, and inspection of the infected region were all performed on the patients (s). Serological tests were performed on the patients, including those for random blood sugar, PCV, WBC, C-reactive protein, and ESR. X-rays showing AP and lateral views of the infected foot were included of imaging examinations (Table 2).

Table 2: Patient's clinical data

Criteria	All patients n = 58
Sex ratio female\male	21\37
Age mean ± SD	61.45 ± 10.23
Site of infection	Toes = 31 (58)
	Heel = 5 (58)
	Other site = 11 (58)
	Mixed (more than one site) = 10 (58)
Patients with osteomyelitis	21 patients (58)
History of the previous infection	45 (58)
History of amputation	19 (58)
Patients need partial or complete toe (s) amputation during wound debridement	17 (58)

The circulation in both lower limbs was evaluated using Doppler tests. Once the patients' blood sugar levels were under control, we sought the advice of an endocrinologist and a vascular surgeon to assess their peripheral circulation.

The IDSA categorization of severe infections, severe ischemia with gangrenous lesions, and diabetic foot ulcers without infection were the exclusion criteria.

Treatments

Treatment for local wounds

We began with abscess drainage and wound debridement while under local anaesthesia (after obtaining wound swabs for culture and sensitivity testing). Some lesions needed 2% iodine solution-soaked gauze as the dressing after irrigation with normal saline solution and minimal surgical excision of the toe or toes. The dressings were changed one to two times each day, depending on the severity. Following early recovery, the patients' wounds were checked every 5 days for the first 3 months, and subsequently every 10–14 days.

Antibacterial Therapy

The empirical use of antibiotics was as follows:

Group 1. For moderate diabetic foot infections, patients in regimen A received oral amoxicillin/clavulanate once every 12 hours with once every 8 hours of metronidazole for 10 to 14 days (Figure 1). For 10–14 days, individuals in regimen B who were allergic to penicillin or who had previously taken penicillin without experiencing a reaction received one dosage each of clindamycin and metronidazole every six hours.

Group 2. For patients in regimen A who had moderate diabetic foot infection with or without osteomyelitis, the treatment was intravenous ampicillin/cloxacillin + metronidazole for five days. If the response was insufficient, the course was repeated, or the patient was switched to an oral regimen that was similar to group 1 regimen A for at least six weeks. Patients in regimen B who had a penicillin allergy or were already taking penicillin without seeing results received intravenous lincomycin plus oral metronidazole for five days, and if the response was insufficient, they either repeated this course or switched to an oral regimen in accordance with group 1 regimen B for at least six weeks (Figure 1).

Drugs

• 1 oral tablets of amoxicillin/clavulanate 1000 mg (CoAmox Acino, Acino, Zurich, Switzerland).
• 2 oral pills of 500 mg metronidazole (Flagyl, Sanofi-Aventis, Gentilly, France).
• (3) Oral tablets containing 300 mg of clindamycin hydrochloride (Lanacin, Al-Mutahida, Amman, Jordan).
• (4) Ampicillin + cloxacillin, intravenous injection, 250 mg/250 mg (LDP Torlan, Barcelona, Spain).
• (5) 600 mg of lincomycin hydrochloride administered intravenously every eight hours (Lincocin, Pfizer, Puurs, Belgium).

outcome evaluation

During the follow-up periods, which were every 5 days during the acute stage (for the first 3 weeks) and every 10-14 days for the next 3 months, we categorised the patients based on how they responded to the care.

According to Lipsky (1997) [15], the outcomes were: (1) cure: all inflammation, pus, and osteomyelitis signs and symptoms had vanished, and the wound had started to heal; (2) improvement: signs and symptoms of infection had been somewhat reduced; and (3) failure: no changes.

Adverse responses to the antimicrobial regimens were secondary outcomes.

Results

After two cases were excluded because of the onset of drug side effects, 58 individuals in total were included in the research. After a 10- to 14-day treatment period, six of the patients in group 1 who received regimen B were completely healed. Of the patients in group 1 who received regimen A, eight were cured (80%), two (20%) failed to react, and group 1 was switched to regimen B. (Table 3).

Table 3 Clinical outcome of 16patients included in group1 (mild diabetic foot infection)

Group 1 No.16	Patients outcome of both regimen A, B of treatment	Regimen A No .10	Regimen B No.6
Cure	13 (16) 87.5%	8 (10) 80%	100%
Improved	0	0	0
Failed	2 (16) 12.5% shifted to G2	2 (10) 20%	0

A total of 42 patients were included in group 2, and 26 received regimen A; 16 patients were cured, 3 improved, and 7 failed to respond at the end of the treatment period (Table 4).

Table 4: 42 individuals participating in group 2 had a complete clinical result at the end of the therapy term (moderate diabetic foot infection)

Group 2 Patients No. 42	Total clinical outcome of both regimen	Regimen A No.26	Regimen B No.16
Cure	26 (42) 64.28%	16 (26) 61.5%	11 (16) 68.75%
Improved	5 (42) 11.9%	3 (26) 11.53%	2 (16) 12.5%
Failed	10 (42) 23.8%	7 (26) 26.9%	3 (16) 18.75%

A total of 16 patients in group 2 received regimen B; 11 were cured, 2 improved, and 3 failed to respond at the end of the treatment period (Tables 4 and 5).

Table 5: Clinical results for group 2 regarding the length of the parenteral injection

Group 2 Patients No.42	6 weeks regimen including 5 days of injectable treatment		6 weeks regimen including 10 days of injectable treatment		6 weeks regimen including 15 days of injectable treatment	
	A No. (%)	B No. (%)	A No. (%)	B No. (%)	A No. (%)	B No. (%)
Cure	12 (28.57%)	4 (9.5%)	4 (9.5%)	6 (14.28%)	0	1 (2.3%)
Improved	2 (4.7%)	1 (2.3%)	1 (2.3%)	1 (2.3%)	0	0
Failed	1 (2.3%)	1 (2.3%)	1 (2.3%)	0	5 (11.9%)	2 (4.7%)

Diarrhea and skin rash were secondary outcomes that occurred in two individuals in group 1 and necessitated treatment adjustments and exclusion. The majority of patients tolerated the antibiotics with little to no stomach distress, which was managed with antacids.

The majority of the Gram-positive species detected in the culture and sensitivity tests of 21 individuals, including staphylococci and streptococci, were. Three individuals had E. coli, and one had pseudomonas, making up the majority of the illnesses.

After 14 days of therapy, two patients in group 1 regimen A were moved to group 1 regimen B and both recovered.

Three months of follow-up included local wound care every 10 to 14 days (after completion of the antibiotic regimens). Thus, (1) there was no recurrence in the cured instances, (2) 3 of the improved cases were cured at the end of the follow-up period, while 2 cases required a second round of antibiotic therapy, and (3) all failed cases required amputation.

Discussion

Diabetes mellitus is a systemic condition accompanied with morbidity-causing consequences. Diabetic foot infection is one of these consequences, which can result in morbidity and death.

Many therapy recommendations result in positive clinical results. All strive for greater success rates with lower amputation risk.

The objective of the current study was to compare surgical and pharmaceutical treatment for mild and moderate diabetic foot infections in outpatients with and without osteomyelitis. We went with the IDSA categorization since it was simpler to use, more applicable to, and typical of our instances. Due to the requirement for hospitalisation, severe cases were omitted. In order to assure protection from contamination, the included patients were treated in an orthopaedic consulting clinic with extensive wound debridement and iodine-soaked dressings. As the first stage in treating diabetic foot infection, wound debridement and care are crucial in order to remove all dead tissue and drain abscesses. Infection may be controlled extremely effectively and the requirement for long-term antibiotic therapy is decreased by frequent daily dressing [16], [17], [18].

We utilised affordable antibiotics in this trial that may be given to outpatients, have been used extensively for a long time, and have recognised adverse effects. Additionally, they comprise all prevalent subtypes of bacteria that cause infections in diabetic feet. These medicines have a success rate that is consistent with recent trials using new generations of antibiotics that are pricey, need hospitalisation, and call for comparable treatment durations [19], [20], [21].

The cure rate in group 1 was 87.5%, which is respectable given that none of the patients had osteomyelitis and all of them responded favourably to the empirical antibiotics that were chosen. This type of wound also had good microorganism coverage and affordable, adequate penetration of the infected skin, soft tissue, and bone. Our findings are consistent with those of De Vries [22], who retrospectively assessed the efficacy of clindamycin and cephalosporin for the treatment of diabetic foot infections brought on by Staphylococcus aureus and other Gram-negative pathogens, with an 87% success rate.

Since metronidazole is well tolerated and has antibacterial efficacy against the majority of anaerobic germs implicated in this condition as well as colitis brought on by Clostridium difficile, it was given to both groups [23]. This might explain why there were just a few adverse events over the course of treatment—two participants in the group receiving oral clindamycin experienced them.

Despite the fact that 20 patients in group 2 had osteomyelitis, which might lower the success rate, the cure rate in both treatment plans was 64.28%. Nevertheless, after the 6-week antibiotic course, 35% of the patients with osteomyelitis were cured, 20% made improvements, and none relapsed during the 3-month follow-up period. There was no requirement for hospitalisation or further expenses (Table 6).

Table 6: Clinical outcome about osteomyelitis involvement

Group 2 Patients with osteomyelitis No.20	6 weeks regimen including 5 days of injectable treatment		6 weeks regimen including 10 days of injectable treatment		6 weeks regimen including 15 days of injectable treatment		Total
	A No.(%)	B No.(%)	A No.(%)	B No.(%)	A No.(%)	B No.(%)	No. (%)
Cure	2 (10%)	0 (0)	1 (5%)	3 (15%)	0	1 (5%)	7 (35%)
Improved	1 (5%)	1 (5%)	1 (5%)	1 (5%)	0	0	4 (20%)
Failed	1 (5%)	1 (5%)	1 (5%)	0 (0)	4 (20%)	2 (10%)	9 (45%)

This study's success rate was comparable to many others, including Yadlapalli's [24] review of 58 patients with osteomyelitis and diabetic foot infections who received 4-6 weeks of intravenous ceftizoxime, ampicillin/ sulbactam, cefoxitin, and vancomycin treatment; 79.3% of the patients recovered, albeit with a different antibiotic regimen. Retrospective reviews of 325 patients treated with oral and oral plus intravenous antibiotics, such as metronidazole, clindamycin, amoxicillin/ clavulanate, ciprofloxacin, and co-trimoxazole, were conducted by Embil et al. in [25]. Contrary to the current trial, patients with abscesses and acute osteomyelitis were excluded, yet they still reported a 75.8% remission rate in the oral plus intravenous regimen. [26]

Reviewing the unsuccessful instances revealed that, despite seeing an endocrinologist, the majority of them were the result of uncontrolled blood sugar; this was mostly owing to the patients in our study's poor socioeconomic position.

Conclusion:

In conclusion, diabetic foot infections treated with surgical debridement and antibiotic regimens resulted in favourable responses and cure rates, as well as decreased expenses and hospitalisation rates, over the research period. The success rate was increased and the length of the antibiotic therapy was decreased with local wound care and appropriate local follow-up. Patients with mild

diabetic foot infections respond better to oral clindamycin and metronidazole, while patients with serious diabetic foot infections, whether or not they have osteomyelitis, respond better to intravenous lincomycin and oral metronidazole.

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