Section: Plastic Surgery

Original Research Article

EVALUATION OF THE EFFICACY OF ANTIBIOTIC-LOADED BEADS IN THE MANAGEMENT OF DIABETIC FOOT OSTEOMYELITIS

Ashok Kumar Pandey[1]

[1]*Consultant Plastic Surgeon, Department of Plastic Surgery, M.G.M. New Bombay Hospital, Vashi, Navi Mumbai, Maharashtra, India.*

Received *: 06/06/2026*
Received in revised form *: 15/07/2026*
Accepted *: 29/07/2026*

Corresponding Author:
Dr. Ashok Kumar Pandey,
Consultant Plastic Surgeon, Department of Plastic Surgery, M.G.M. New Bombay Hospital, Vashi, Navi Mumbai, Maharashtra, India.
Email: drashok_pandey@yahoo.co.in

DOI: 10.70034/ijmedph.2026.3.812

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (3); 5273-5279

ABSTRACT

Background: Diabetic foot osteomyelitis (DFO) is an important complication of diabetes mellitus. Its associated with prolonged treatment, recurrent infections and increased risk of amputation. Local antibiotic delivery systems including antibiotic-loaded beads have emerged as a promising adjunct to conventional treatment. These beads provide sustained high concentrations of antimicrobial agents directly at the site of infection. This study was undertaken to evaluate the efficacy of antibiotic-loaded beads in improving clinical outcomes among patients presenting with DFO.

Materials and Methods: A prospective comparative study was conducted in the Department of Plastic Surgery of a tertiary care teaching hospital over a period of 5 years. Eighty patients with diabetic foot osteomyelitis were enrolled and divided into two groups of 40 patients each. Group A received surgical debridement, systemic antimicrobial therapy and implantation of biodegradable antibiotic-loaded beads. Patients in Group B received surgical debridement and systemic antimicrobial therapy without bead implantation. Patients were followed for six months. Outcome measures included wound healing rate, healing duration, need for additional debridement, amputation rates and duration of hospital stay. SPSS version 26.0 was used for statistical analysis and P value less than 0.05 was considered statistically significant.

Results: Baseline demographic, clinical and infection-related characteristics were comparable between groups. Complete wound healing was achieved in 90.0% of patients in the bead group compared with 75.0% in the non-bead group. Moreover, mean healing duration was significantly shorter in the bead group (68.5 ± 21.4 days vs. 82.7 ± 27.6 days; p=0.014). A significantly greater proportion of patients in the bead group achieved healing within 12 weeks (60.0% vs. 37.5%; p=0.043). Lower rates of infection recurrence (7.5% vs. 20.0%), minor amputation (5.0% vs. 15.0%) and major amputation (2.5% vs. 7.5%) were observed in the bead group although these differences were not statistically significant. Limb salvage rates were 97.5% and 92.5%, respectively.

Conclusion: Adjunctive use of antibiotic-loaded beads in diabetic foot osteomyelitis was found to be associated with significantly faster wound healing and improved early healing outcomes. Favorable trends toward reduced recurrence and amputation rates suggest that local antibiotic delivery may contribute to improved limb preservation in patients with DFO.

MeSH Keywords: Diabetic Foot, Osteomyelitis, Anti-Bacterial Agents, Drug Delivery Systems, Limb Salvage.

INTRODUCTION

Diabetic foot osteomyelitis (DFO) is a serious and limb-threatening complication of diabetes mellitus, usually developing from contiguous spread of infection from chronic neuropathic foot ulcers. It is associated with prolonged morbidity, recurrent hospital admissions, need for repeated debridement, and increased risk of minor or major amputation. Osteomyelitis is reported in approximately 10–15% of moderate diabetic foot infections and up to 50% of severe infections, making it one of the most clinically important forms of diabetic foot disease.[1] With the increasing global burden of diabetes, DFO represents a growing public health concern, particularly in resource-limited settings where delayed presentation, poor glycaemic control, peripheral neuropathy, peripheral arterial disease, and inadequate wound care contribute to disease progression. Effective management of DFO is therefore essential not only for infection control, but also for limb salvage, functional preservation, and reduction of healthcare costs.

The management of diabetic osteomyelitis remains challenging because infection occurs in poorly vascularized bone and surrounding soft tissue, where systemic antibiotic penetration may be suboptimal. Standard treatment includes culture-directed systemic antibiotics, surgical debridement or resection of infected bone when indicated, offloading, vascular optimization, glycaemic control, and meticulous wound care.[2] However, prolonged systemic antibiotic therapy is associated with adverse drug reactions, poor adherence, antimicrobial resistance, and treatment failure, especially in polymicrobial infections or in the presence of biofilm. Additionally, extensive surgical resection may compromise foot functions because of altered biomechanics thereby increasing the risk of recurrent ulceration. These limitations have encouraged interest in the use of adjunctive local antibiotic delivery systems that is expected to achieve high antimicrobial concentrations at the infected site itself while minimizing systemic toxicity.

Antibiotic-loaded beads which are commonly prepared using carriers such as polymethylmethacrylate or calcium sulfate provide targeted local drug delivery after debridement of infected tissue. These beads can fill dead space and maintain high local antibiotic levels thereby potentially reducing residual bacterial burden in affected bone cavities. Bioabsorbable calcium sulfate beads have gained attention because they do not require removal and may provide sustained elution of antibiotics such as vancomycin, gentamicin, tobramycin, or combinations selected according to local microbiology.[3] The theoretical advantages of this approach are particularly relevant in DFO, where local ischemia, biofilm formation, and recurrent infection often impair the success of systemic therapy alone.

Clinical evidence regarding antibiotic-loaded beads in DFO is promising but heterogeneous. Some studies and reviews suggest improved infection clearance, faster wound healing and increased chances of limb salvage in cases in whom local antibiotic delivery is used as an adjunct to usual surgical debridement and systemic antibiotics.[4] Nevertheless, available studies vary in bead material, choice of antibiotics, type of surgery, severity of infection, and vascular status . Reported complications include persistent wound discharge, delayed wound healing, and recurrence of osteomyelitis. This is more common in cases where local antibiotic therapy is used without adequate debridement or vascular assessment.[5] Recent evidence has renewed interest in bioabsorbable antibiotic delivery for DFO. However broader validation is needed for diverse clinical settings in which these antibiotics are used.[6]

Despite increasing use of antibiotic-loaded beads there is a significant knowledge gap regarding true efficacy of these antibiotic-loaded beads in cases of diabetic osteomyelitis. Existing literature is limited by studies with small sample sizes, retrospective designs, and variable follow-up periods. This study intends to fill this gap by evaluating the clinical efficacy of antibiotic-loaded beads in the management of diabetic osteomyelitis. The emphasis of this study is on infection control, wound outcomes in terms of healing, need for repeat surgical intervention and limb salvage. The study may help clarify the role of local antibiotic delivery as an adjunctive strategy in multidisciplinary management of cases with DFO.

MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of Plastic Surgery at a tertiary care hospital over a period of five years. Written informed consent was obtained from all patients before enrolment in the study. Patients diagnosed with diabetic foot osteomyelitis were consecutively recruited during the study period on the basis of a predefined inclusion and exclusion criteria. The sample size was calculated on the basis of previously published studies evaluating treatment outcomes in diabetic foot osteomyelitis. Assuming a clinically meaningful difference in healing rates between treatment groups, with a two-sided significance level (α) of 5% and a statistical power of 80% to detect this difference, the minimum required sample size was estimated. An additional 10% allowance was considered to compensate for potential losses to follow-up and incomplete data, ensuring adequate precision and reliability of the study findings. A total of 80 patients were included in the study and allocated into two groups comprising 40 patients each.

All patients underwent detailed clinical evaluation at the time of presentation. This included documentation of demographic characteristics and duration of diabetes mellitus. Additionally, Presence of associated comorbidities, duration of foot ulceration, previous treatment history, and glycaemic status was also documented. Clinical examination included assessment of ulcer size, depth, presence of exposed bone, signs of local infection, peripheral vascular status and neurological involvement. Laboratory investigations such as complete blood count, erythrocyte sedimentation rate, C-reactive protein, fasting blood glucose, postprandial blood glucose, glycated hemoglobin (HbA1c) and renal function tests were done in all cases. Plain radiographs of the affected foot were obtained in all patients, while cross sectional imaging was performed whenever required to determine the extent of osseous involvement. The diagnosis of diabetic foot osteomyelitis was established on the basis of clinical, radiological, microbiological and intraoperative findings. Deep tissue and bone specimens obtained during surgery were sent for microbiological culture and antimicrobial sensitivity testing.

Following optimization of glycaemic control all patients underwent thorough surgical debridement under appropriate anesthesia. The procedure involved excision of necrotic soft tissue, infected bone as well as devitalized tissue and purulent collections until healthy viable tissue margins were achieved. Empirical intravenous antimicrobial therapy was initiated during the perioperative period and subsequently was modified in accordance with culture and sensitivity reports.

Following debridement, patients were managed according to their respective treatment protocols:

Group A (Antibiotic-Loaded Bead Group; n = 40): Patients received intravenous antimicrobial therapy during hospitalization along with implantation of biodegradable antibiotic-loaded beads within the debrided cavity. When microbiological culture and sensitivity reports were available, the antibiotic incorporated into the beads was selected accordingly. In cases where culture reports were pending at the time of performing surgery, empirically selected antimicrobial agents were used for beads preparation. These beads were later modified during subsequent applications whenever required based on culture and sensitivity reports. Regular wound care was provided. Repeat debridement with reapplication of antibiotic-loaded beads was performed whenever persistent infection or residual slough was identified during follow-up.

Figure 1: Intraoperative implantation of antibiotic-loaded biodegradable beads following debridement of diabetic foot osteomyelitis (left) and Preoperative radiograph demonstrating Osteomyelitis changes in the first metatarsal region (right)

Figure 2: Radiograph (left) and clinical photograph (right) showing antibiotic-loaded biodegradable beads implanted within a debrided diabetic foot osteomyelitis cavity during local antibiotic therapy

Group B (Non-Bead Group; n = 40): Patients in this group received the same perioperative intravenous antimicrobial therapy during hospitalization but these cases did not undergo local antibiotic bead implantation. Following discharge, these patients were prescribed oral antimicrobial therapy on the basis of microbiological culture and sensitivity reports along with routine wound care and regular dressing changes throughout the treatment period.

Standard diabetic foot care measures, including optimization of glycaemic control, pressure off-loading, nutritional support, and management of associated comorbidities, were provided uniformly to both groups. Patients were reviewed at regular intervals of three weeks in the outpatient department and were followed for a period of six months. During each follow-up visit, wound status, granulation tissue formation, evidence of persistent or recurrent infection, and the need for further surgical intervention were assessed. Complete wound healing was defined as complete epithelialization of the ulcer without any clinical evidence of active local infection. Ulcers that failed to achieve complete healing within six months of management were considered treatment failures. Outcome measures such as wound healing rate, duration of wound healing, recurrence of wound infection, requirement for additional surgical procedures, duration of hospital stay and limb salvage rate.

All clinical, laboratory, microbiological, radiological, operative, and follow-up data were prospectively recorded using a structured study proforma. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Comparisons between the two groups were performed using the independent Student's t-test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables, as appropriate. A p-value of less than 0.05 was considered statistically significant.

Inclusion Criteria

- Patients aged 18 years and above.
- Patients with type 2 diabetes mellitus.
- Patients diagnosed with diabetic foot osteomyelitis.
- Patients presenting with diabetic foot ulcers treated by surgical debridement.
- Patients willing to provide written informed consent and comply with the follow-up protocol.

Exclusion Criteria

- Patients with osteomyelitis secondary to causes other than diabetic foot infection.
- Patients requiring primary major amputation at presentation.
- Patients with critical limb ischemia requiring urgent vascular intervention.
- Patients with severe systemic illness precluding surgical treatment.
- Patients with malignancy involving the affected limb.
- Pregnant or lactating women.
- Patients unwilling to participate in the study.
- Patients lost to follow-up before completion of the six-month follow-up period.

RESULTS

The study included 80 patients with diabetic foot osteomyelitis, equally distributed between the antibiotic-loaded bead group and the non-bead group. Baseline demographic characteristics were comparable between the two groups. Males constituted the majority of the study population in both groups. There was no statistically significant difference in gender distribution in both the studied groups. [Figure 3]

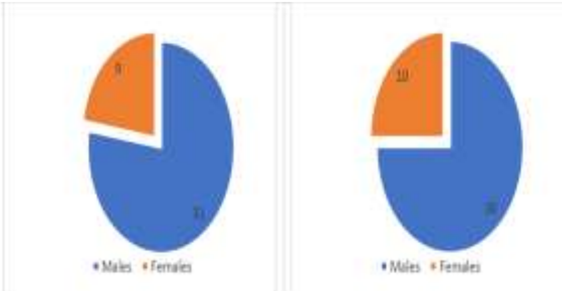

Figure 3: Gender Distribution of Study Participants

The age profile of the study population was similar in both groups. Most patients belonged to the age group above 60 years, reflecting the higher burden of diabetic foot complications in older individuals. The mean age of cases in group A and B was found to be 58.4 ± 8.7 and 59.8 ± 9.1 years respectively. No significant difference was observed in age distribution or mean age between the study groups. [Table]

Table 1: Age Distribution of Study Participants

Age Group (Years)	Bead Group (n=40)		Non-Bead Group (n=40)		P
	n	%	n	%	p = 0.482
<50	8	20.0	6	15.0	
50–60	14	35.0	15	37.5	
>60	18	45.0	19	47.5	
Mean Age	58.4 ± 8.7		59.8 ± 9.1		

Body mass index distribution was also comparable between the two groups. Overweight and obese individuals comprised the majority of the study population, consistent with the known association between obesity and diabetes mellitus. The mean BMI of cases in group A and B was found to be 28.7 ± 3.8and 29.2 ± 4.1 kg/m² respectively. [Table 2]

Table 2: Body Mass Index Distribution Among Study Participants

BMI Category (kg/m²)	Bead Group (n=40)		Non-Bead Group (n=40)		P
	n	**%**	**n**	**%**	0.571
Normal (18.5–24.9)	8	20.0	7	17.5	
Overweight (25–29.9)	19	47.5	18	45.0	
Obese (≥30)	13	32.5	15	37.5	
Mean BMI (kg/m²):	28.7 ± 3.8		29.2 ± 4.1		

Diabetes-related clinical characteristics demonstrated no statistically significant differences between the groups. The duration of diabetes, glycaemic control, and prevalence of associated comorbidities were broadly comparable, indicating similar baseline disease burden in both cohorts. [Table 3]

Table 3: Diabetes-Related Characteristics of the Study Population

Variable	Bead Group (n=40)	Non-Bead Group (n=40)	p-value
	n/Mean±SD	n/Mean±SD	
Duration of diabetes (years)	11.6 ± 4.9	12.1 ± 5.3	0.661
HbA1c (%)	8.42 ± 1.11	8.57 ± 1.24	0.578
Fasting blood sugar (mg/dL)	164.8 ± 28.5	170.2 ± 31.4	0.421
Peripheral neuropathy	29 (72.5 %)	31 (77.5 %)	0.604
Hypertension	24 (60.0 %)	22 (55.0 %)	0.649
Chronic kidney disease	7 (17.5 %)	8 (20.0 %)	0.774
Smoking history	15 (37.5 %)	17 (42.5 %)	0.648

Baseline ulcer characteristics were comparable between the two treatment groups. Ulcer size, duration of ulceration, prevalence of exposed bone, and previous ulcer history showed no significant intergroup differences at presentation. [Table 4]

Table 4: Baseline Ulcer Characteristics

Variable	Bead Group (n=40)	Non-Bead Group (n=40)	p-value
	n/Mean±SD	n/Mean±SD	
Mean ulcer size (cm²)	4.3 ± 1.5	4.6 ± 1.7	0.409
Duration of ulcer (weeks)	5.9 ± 2.4	6.2 ± 2.6	0.597
Previous ulcer history	13 (32.5%)	15 (37.5%)	0.638
Exposed bone present	21 (52.5%)	19 (47.5%)	0.654
Multiple ulcers	8 (20.0%)	10 (25.0%)	0.592
Previous minor amputation	5 (12.5%)	6 (15.0%)	0.744

The severity and anatomical distribution of osteomyelitis were similar in both groups. Most cases involved the forefoot, and inflammatory markers at presentation did not differ significantly between the treatment cohorts. [Table 5]

Table 5: Osteomyelitis and Infection Characteristics

Variable	Bead Group (n=40)	Non-Bead Group (n=40)	p-value
	n/Mean±SD	n/Mean±SD	
Probe-to-bone positive	26 (65.0%)	24 (60.0%)	0.643
Forefoot involvement	25 (62.5%)	23 (57.5%)	0.648
Midfoot involvement	10 (25.0%)	11 (27.5%)	0.801
Hindfoot involvement	5 (12.5%)	6 (15.0%)	0.744
ESR (mm/hr)	67.4 ± 18.6	69.1 ± 19.2	0.689
CRP (mg/L)	41.2 ± 12.5	43.8 ± 13.7	0.381
Leukocyte count (/mm³)	12,380 ± 2,540	12,810 ± 2,720	0.471

Microbiological analysis demonstrated Staphylococcus aureus as the most commonly isolated pathogen, followed by Enterococcus and Klebsiella species. Polymicrobial infection was observed in 22 (27.5%) patients, whereas 55 (68.8%) patients had monomicrobial infection. No microbial growth was observed in 3 (3.8%) patients. [Table 6]

Table 6: Microbiological Profile of Diabetic Foot Osteomyelitis

Organism Isolated	Bead Group (n=49 isolates)	Non-Bead Group (n=50 isolates)	Total Isolates (n=99)
Staphylococcus aureus	17 (34.7%)	17 (34.0%)	34 (34.3%)
Enterococcus spp.	9 (18.4%)	10 (20.0%)	19 (19.2%)
Klebsiella spp.	8 (16.3%)	7 (14.0%)	15 (15.2%)
Pseudomonas aeruginosa	6 (12.2%)	6 (12.0%)	12 (12.1%)
Escherichia coli	5 (10.2%)	6 (12.0%)	11 (11.1%)
Proteus spp.	4 (8.2%)	4 (8.0%)	8 (8.1%)
Total isolates	49 (100%)	50 (100%)	99 (100%)

Clinical outcome assessment demonstrated higher healing rates, shorter healing duration, lower recurrence rates, and better limb preservation in the bead group compared with the non-bead group. A significantly greater proportion of patients in the bead group achieved wound healing within 12 weeks, and the mean duration of healing was significantly shorter. Although recurrence and amputation rates were lower in the bead group, these differences did not reach statistical significance. [Table 7]

Table 7: Comparison of Clinical Outcomes Between the Study Groups

Variable	Bead Group (n=40)		Non-Bead Group (n=40)		p-value
	n/Mean±SD	%	n/Mean±SD	%	
Complete wound healing	36	90.0	30	75.0	0.073
Non-healing ulcer	4	10.0	10	25.0	
Mean healing duration (days)	68.5 ± 21.4	—	82.7 ± 27.6	—	0.014*
Healed within 12 weeks	24	60.0	15	37.5	0.043*
Infection recurrence	3	7.5	8	20.0	0.103
Additional debridement required	6	15.0	10	25.0	0.260
Minor amputation	2	5.0	6	15.0	0.136
Major amputation	1	2.5	3	7.5	0.307
Limb salvage achieved	39	97.5	37	92.5	0.307
Mean hospital stay (days)	8.9 ± 2.4	—	7.4 ± 2.1	—	0.004*

DISCUSSION

Diabetic foot osteomyelitis is one of the most difficult complications of diabetes to manage. Successful management requires meticulous debridement, appropriate antimicrobial therapy, and good glycemic control. In the present study, the addition of antibiotic-loaded biodegradable beads resulted in significantly faster wound healing as compared to conventional treatment alone. Patients who received beads healed earlier and a greater proportion of them achieved complete healing within 12 weeks of treatment. Although the overall healing rate was higher in the bead group the difference did not reach statistical significance. This may be related to the relatively small sample size. Our findings are consistent with those of Qin et al,[7] who reported favorable outcomes following the use of antibiotic-impregnated calcium sulfate in cases of diabetic foot osteomyelitis. Chatzipapas et al,[8] also reported the potential benefits of local antibiotic delivery systems as an adjunct to standard management in cases of diabetic foot osteomyelitis. The improved healing seen in this study may be due to sustained release of antibiotics at the site of infection. This sustained release helps reduce the bacterial burden and promotes tissue recovery after debridement.

In this study both groups were well matched with respect to demographic and clinical characteristics. Most patients were older adults with long-standing diabetes, poor glycemic control and a high prevalence of peripheral neuropathy. These findings were expected as these factors are well known to increase the risk of diabetic foot infection and consequently osteomyelitis. Similar patient profiles have been described by Lipsky et al,[9] and Game et al.[10] Both of these authors emphasized the important role of neuropathy, chronic hyperglycemia, and delayed presentation in the development of diabetic foot complications including osteomyelitis. In our study, the mean HbA1c level was above 8% in both groups, indicating suboptimal diabetic control in both the groups. Despite these unfavourable baseline characteristics, patients treated with antibiotic-loaded beads achieved better healing outcomes. This observation suggests that local antibiotic therapy may provide additional benefit even in patients with suboptimal glycemic control. The similarity of baseline characteristics between the groups also supports the reliability of the treatment comparisons observed in this study.

The microbiological findings in this study were comparable to those reported in previous similar studies. In this study staphylococcus aureus was found to be the most common organism. It was followed by Enterococcus species and various Gram-negative bacteria. Polymicrobial infections were also frequently encountered. Similar observations have been reported by Soldevila-Boixader et al.[11] Chronic osteomyelitis is often associated with biofilm formation which in many instances can reduce the effectiveness of systemic antibiotics. Fletcher et al,[12] demonstrated that antibiotic-loaded calcium sulfate beads can provide significant antimicrobial activity against organisms commonly which are commonly isolated from diabetic foot infections. The ability to achieve high local antibiotic concentrations without increasing systemic toxicity is an important advantage of this approach and may partly explain the favorable outcomes observed in our patients.

Another notable finding of the present study was the lower rate of infection recurrence in the bead group. Recurrence occurred in only a small proportion of patients who received local antibiotic therapy. On the other hand, recurrence was nearly three times higher among patients treated without beads. Similarly, fewer patients in the bead group required additional debridement or underwent amputation. Although these differences were not found to be statistically significant, they are nonetheless clinically important because recurrent infection often leads to prolonged treatment, repeated hospitalization and increased risk of limb loss. Comparable results have been reported by Alkayali et al,[13] who observed lower recurrence rates and encouraging limb outcomes with biodegradable calcium sulfate antibiotic carriers in terms of limb preservation. The reduced recurrence seen in our study may reflect more effective eradication of residual infection following surgery. By maintaining therapeutic antibiotic concentrations within the debrided cavity, antibiotic-loaded beads may help eliminate bacteria that survive surgical debridement and systemic therapy.

Preservation of the affected limb remains one of the primary goals in the management of diabetic foot osteomyelitis. In the present study, limb salvage was achieved in nearly all patients, with slightly better results in the bead group. Although the difference was not statistically significant, the trend favored local antibiotic therapy. Similar findings have been described by Monami et al,[14] and Shen et al.[15] Taken together, these findings suggest that local antibiotic therapy may represent a valuable adjunct in the multidisciplinary management of diabetic foot osteomyelitis.

The present study has certain limitations, including its single-center design, relatively small sample size, and follow-up period of six months. Long-term outcomes such as late recurrence and re-ulceration could not be assessed. Nevertheless, the study provides prospective evidence that antibiotic-loaded biodegradable beads can accelerate wound healing and may contribute to better infection control and limb preservation. Larger multicenter studies with longer follow-up are needed to further define their role and establish standardized treatment protocols.

CONCLUSION

The adjunctive use of antibiotic-loaded beads in the management of diabetic foot osteomyelitis resulted in improved clinical outcomes, particularly in terms of faster wound healing and a higher proportion of wounds healing within 12 weeks. Although reductions in infection recurrence, re-debridement, and amputation rates did not achieve statistical significance, consistent favorable trends were observed. These findings suggest that local antibiotic delivery may enhance conventional treatment strategies and contribute to improved limb preservation and infection control in patients with diabetic foot osteomyelitis.

Conflict of Interest: None

Source of Funding: None

REFERENCES

1. Berendt AR, Peters EJG, Bakker K, Embil JM, Eneroth M, Hinchliffe RJ, et al. Diabetic foot osteomyelitis: a progress report on diagnosis and a systematic review of treatment. Diabetes Metab Res Rev. 2008;24(Suppl 1):S145-S161. doi:10.1002/dmrr.836. PMID: 18442183.
2. Schaper NC, van Netten JJ, Apelqvist J, Bus SA, Hinchliffe RJ, Lipsky BA, et al. Practical Guidelines on the prevention and management of diabetic foot disease (IWGDF 2019 update). Diabetes Metab Res Rev. 2020;36(Suppl 1):e3266. doi:10.1002/dmrr.3266. PMID: 32176447.
3. Gauland C. Managing lower-extremity osteomyelitis locally with surgical debridement and synthetic calcium sulfate antibiotic tablets. Adv Skin Wound Care. 2011;24(11):515-523. doi:10.1097/01.ASW.0000407647.12832.6c. PMID: 22015750.
4. Aragón-Sánchez J. Treatment of diabetic foot osteomyelitis: a surgical critique. Int J Low Extrem Wounds. 2010;9(1):37-59. doi:10.1177/1534734610361949. PMID: 20207622.
5. Giurato L, Meloni M, Izzo V, Uccioli L. Osteomyelitis in diabetic foot: a comprehensive overview. World J Diabetes. 2017;8(4):135-142. doi:10.4239/wjd.v8.i4.135. PMID: 28465790; PMCID: PMC5394733.
6. Da Ros R, Assaloni R, Michelli A, Brunato B, Miranda C. Antibiotic and surgical treatment of diabetic foot osteomyelitis: the histopathological evidence. Antibiotics (Basel). 2024;13(12):1142. doi:10.3390/antibiotics13121142. PMID: 39766532; PMCID: PMC11672856.
7. Qin CH, Zhou CH, Song HJ, Cheng GY, Zhang HA, Fang J, et al. Infected bone resection plus adjuvant antibiotic-impregnated calcium sulfate versus infected bone resection alone in the treatment of diabetic forefoot osteomyelitis. BMC Musculoskelet Disord. 2019;20:246.
8. Chatzipapas C, Karaglani M, Papanas N, Tilkeridis K, Drosos GI. Local antibiotic delivery systems in diabetic foot osteomyelitis: a brief review. Rev Diabet Stud. 2021;17(2):75-81. doi:10.1900/RDS.2021.17.75. PMID: 34852898; PMCID: PMC9380086.
9. Lipsky BA, Senneville É, Abbas ZG, Aragón-Sánchez J, Diggle M, Embil JM, et al. Guidelines on the diagnosis and treatment of foot infection in persons with diabetes (IWGDF 2019 update). Diabetes Metab Res Rev. 2020;36(Suppl 1):e3280. doi:10.1002/dmrr.3280. PMID: 32176444.
10. Game FL. Osteomyelitis in the diabetic foot: diagnosis and management. Med Clin North Am. 2013;97:947-956. doi:10.1016/j.mcna.2013.03.010.
11. Soldevila-Boixader L, Fernández AP, Laguna JM, Uçkay I. Local antibiotics in the treatment of diabetic foot infections: a narrative review. Antibiotics (Basel). 2023;12:124. doi:10.3390/antibiotics12010124.
12. Fletcher J, Porter R, Boulton Z, Brown L, Knight B, Romanczuk L, et al. In vitro efficacy of antibiotic loaded calcium sulfate beads (Stimulan Rapid Cure) against polymicrobial communities and individual bacterial strains derived from diabetic foot infections. J Med Microbiol. 2022;71(5). doi:10.1099/jmm.0.001517. PMID: 35604937.
13. Alkayali T, Casciato D, Wynes J, Chua J, Doub JB. Are biodegradable calcium sulfate antibiotic beads effective and safe adjuvants for diabetic foot osteomyelitis? Cureus. 2024;16(1):e52444. doi:10.7759/cureus.52444. PMID: 38371037; PMCID: PMC10871154.
14. Monami M, Ragghianti B, Nreu B, et al. Major amputation in non-healing ulcers: outcomes and economic issues. Data from a cohort of patients with diabetic foot ulcers. Int J Low Extrem Wounds. Published online April 28, 2022.
15. Shen D, Huang K, Guo Q, Ma G, Ding L. The efficacy of local antibiotic delivery systems therapy in the management of diabetic foot osteomyelitis: a systematic review and meta-analysis. Int J Low Extrem Wounds. 2026;25(2):379-388. doi:10.1177/15347346241266062. PMID: 39033388.