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ORIGINAL ARTICLE

Treatment of Foot and Ankle Infection with Antibiotic Cement Spacer

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Abstract

Purpose: The present paper analyzed the results of treatment of foot and ankle infection with antibiotic cement.

Materials and methods: Twenty-seven patients who underwent surgical treatment for bone infections of the foot and ankle using an antibiotic cement spacer during the period from July 2014 to June 2019, and were followed up for more than one year were selected as subjects for the present retrospective analysis. The subject was divided into Group A (19 subjects), in which the antibiotic cement spacer was removed during treatment, and Group B (8 subjects), with non-removal of antibiotic cement spacers during treatment, for analysis in the present study. The erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), white blood cell count between the time of the initial infection diagnosis and 6-weeks after surgery were analyzed, together with complications occurring within one year after completion of the surgical treatment.

Results: The subjects in both groups exhibited reductions in ESR, CRP, and WBC count 6 weeks after the surgical treatment compared to the results before surgery. No cases of additional amputations due to failure of infection control were commonly observed in Groups A and B, however five episodes of complications were observed in Group A and two episodes of complications were observed in Group B, respectively. However, significant differences were not found between the two groups.

Conclusions: The use of antibiotic cement spacers in surgery for the treatment of bone infection in the foot and ankle rendered satisfactory outcomes. Further, it was also found that satisfactory outcomes could be obtained without removal of the antibiotic cement spacer over a short-term follow-up.

Keywords

Infection, Foot and ankle, Antibiotic cement spacer

Introduction

Antibiotic cement spacers have been used in various aspects of orthopedic fields including bone infection and open fracture [1-3]. Surgical excision and debridement of non-viable and infected soft tissue and bone followed by antibiotic cement spacer placement were performed to alleviate bone infection [2,4].

There are some literatures concerning the treatment using antibiotic cement spacer in foot and ankle infection [1-6]. But there are only few literatures with respect to the appropriate time of removing the cement spacer and complications that occur without its removal.

The purpose of this study is to analyze the results of treatment of foot and ankle infection with an antibiotic cement spacer.

Materials and Methods

Twenty-seven patients who underwent surgical treatment for bone infections of the foot and ankle using an antibiotic cement spacer during the period from July 2014 to June 2019, and were followed up for more than one year were selected as subjects for the current retrospective analysis. The subject was divided into Group A (19 subjects), in which the antibiotic cement spacer was removed during treatment, and Group B (8 subjects), with non-removal of antibiotic cement spacers during treatment, for analysis in the present study. The erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and white blood cell (WBC) count between the time of the initial infection diagnosis and 6 weeks after surgery were analyzed, together with com-

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plications occurring within one year after completion of the surgical treatment.

P-values were calculated using Pearson's chi-square test, Fisher's exact test and Mann-Whitney U test. P-value less than 0.05 was considered to indicate statistical significance.

Results

There were 14 cases of infection of the toes or metatarsophalangeal joint, 2 cases of the infection of the midfoot, 5 cases of infection of the calcaneus and 6 cases of infection of the ankle joint. The average time of removal of the cement spacer was 43.6 days. The subjects in both groups exhibited reductions in ESR, CRP, and WBC count 6 weeks after the surgical treatment compared to the results before surgery, but there were no significant differences between the two groups. No cases of additional amputations due to failure of infection control were commonly observed in Groups A and B; however, five episodes of complications were observed in Group A and two episodes of complications were observed in Group B, respectively. However, significant differences were not found between the two groups (Table 1).

Discussions

Since Haboush, [7] introduced the application of bone cement in total hip arthroplasty to achieve stability of the femoral stem, bone cement has been used in total hip arthroplasty only. Buchholz and Engelbrecht, [8] reported the surgical outcomes of the treatment of deep infection after total hip arthroplasty using antibiotic bone cement, and afterwards, it has been used widely in open fracture, infected arthroplasty, non-union, and acute or chronic osteomyelitis [4]. With respect to the foot and ankle infection, an antibiotic cement spacer plays an important role of alleviating infections by prevention soft tissue contracture or bone shortening and avoiding amputation [1,2,4,5].

The antibiotic chosen for bone cement should have a broad spectrum of microbicidal activity and it should not cause any serious allergic reaction in the human body [3,4]. Gentamycin and Vancomycin have been used in bone cement as they have all of these characteristics [2,9,10]. Although the mechanism of antibiotic release is still debated, it is hypothesized that elution of the antibiotic from bone cement occurs rapidly and in large amounts during the first days and it progressively decreases until about 2 to 14 days, with the remaining antibiotic persisting with a clinically insignificant release over several years [3-6,11].

Antibiotic bone cement can have a direct effect on the infected area where the biofilm is already formed because it has a relatively high dose of antibiotics, compared to systemic antibiotics [8,9]. Thus, it can be an alternative treatment even in patients with peripheral vascular disease and those with serious side effects of systemic antibiotics [6]. But the use of intravenous antibiotics should not be stopped because residual infection may remain or suboptimal antibiotic sensitivity may exist [5]. In this study, systemic antibiotics were additionally used in all cases but the duration of the antibiotic administration was 2 weeks less than 6 weeks on average in bone infection [1,2]. The authors believed that the use of antibiotic cement spacer in combination with systemic antibiotics may shorten the treatment period for foot and ankle bone infection.

Table 1: Association of variables between group A (removal of antibiotic bone cement spacer) and group B (not removal).

		Group A (n = 19)	Group B (n = 8)	P-value
Male		6	3	> 0.999
Female		13	5	
Age		60.79 ± 9.20	66.25 ± 7.36	0.089
DM		11 (57.9%)	1 (12.5%)	0.043
Location	Metatarsophalangeal joint	8	1	0.105
	Ankle	3	3	
	Calcaneus	4	1	
	Midfoot	0	2	
	Toe	4	1	
ESR(mm/h)	Pre-op	45.95 ± 32.98	37.25 ± 26.41	0.595
	Follow up	19.58 ± 19.63	28.00 ± 18.29	0.159
CRP(mm/h)	Pre-op	27.12 ± 50.95	36.69 ± 83.40	0.541
	Follow up	7.51 ± 18.34	6.16 ± 11.95	0.441
WBC count (x10^3 cells/μl)	Pre-op	8.10 ± 2.52	7.78 ± 3.19	0.595
	Follow up	6.38 ± 1.46	6.18 ± 1.65	0.937
Duration of administration of antibiotic (weeks)		4.79 ± 2.37	4.13 ± 2.03	0.517
Complications		5(26.3%)	2 (25.0%)	> 0.999

Melamed EA, et al. [2] reported that the antibiotic cement spacer was not removed in 10 of 23 cases and there were no serious complications, such as recurrence of infection except for callosity of the foot. Elmarsafi T, et al. [5] reported that there were no complications during an average follow-up of 52 months without removal of the antibiotic cement spacer. Although there might be an adverse effect, the antibiotic spacer could serve as a site for bacterial colonization long after release of the antibiotic [2,6]. There was no case of incomplete wound healing or recurrence of infection for 1 year in our patients.

A Callosity was formed on the plantar side of the fore-foot in 2 cases in which the antibiotic cement spacer was not removed at the first metatarsophalangeal (MP) joint. We believed that pressure might have been transmitted to the lesser toes and a callosity could have formed because the cement spacer could not resist the weight bearing on the first MP joint [12-14]. The antibiotic cement spacer may provide structural stability and allow motion but careful attention should be paid when the cement spacer is inserted in a weight bearing position, such as a metatarsal head.

This report is limited as our study was retrospective in nature and it had a small sample size.

Conclusions

The use of antibiotic cement spacers in surgery for the treatment of bone infection in the foot and ankle achieved satisfactory outcomes. Further, it was also found that satisfactory outcomes could be obtained without removal of the antibiotic cement spacer over a short-term follow-up.

Authors Declaration

The authors declare that authors have no conflict of interest.

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