DOI: 10.4274/jarem.galenos.2018.2333
J Acad Res Med 2020;10(2):106-10

The Effect of Using a Dose of Prophylactic Antibiotics on Spondylodiscitis in Lumbar Disc Surgery

Furkan Diren[1], Mehmet Bülent Onal[2], Halil Can[3], Atilla Kırcelli[4]

[1]University of Health Sciences Turkey, Gaziosmanpaşa Training and Research Hospital, Clinic of Neurosurgery, İstanbul, Turkey
[2]İstanbul Acıbadem University Health Vocational School, İstanbul, Turkey
[3]Biruni University Hospital, Clinic of Neurosurgery, İstanbul, Turkey
[4]Başkent University, İstanbul Health Practice and Research Center Hospital, Clinic of Neurosurgery, İstanbul, Turkey

Cite this article as: Diren F, Onal MB, Can H, Kırcelli A. The Effect of Using a Dose of Prophylactic Antibiotics on Spondylodiscitis in Lumbar Disc Surgery. J Acad Res Med 2020;10(2):106-10

ABSTRACT

Objective: Although spondylodiscitis seen after lumbar discectomy is very rare, its incidence has been reported to be around 0.1-18.8% by many different authors. The most common pathogen is *Staphylococcus aureus*.

Methods: Medical records of 1,154 patients who were operated in our hospital between 2007 and 2015 due to a single or two-level lumbar disc hernia were retrospectively extracted. Of these patients, 554 were female and 600 were male. Discectomy operation was performed in 1,062 of these patients with single-level and 91 with two-level lumbar microdiscectomy. All of these patients were given a prophylactic single dose of cefazolin sodium in accordance with the recommendations of the surgical antimicrobial prophylaxis guidelines during anesthesia. Spondylodiscitis developed in 12 patients (1.03%). Comorbidities in patients who developed spondylodiscitis, isolated pathogens, antibiotic susceptibility, antibiotics used, and hospital stay were noted.

Results: Of the 12 patients, 7 were female and 5 were male. Mean age was 45.75±14.16 years. Eleven of these patients underwent single level, one had 2 levels of lumbar microdiscectomy. Five patients underwent discectomy at L4-5 and 8 patients at L5-S1 levels. Three of these patients had *S. aureus* (25%), 4 had *Staphylococcus epidermidis* (33%) and 3 had *Escherichia coli* (25%) and 2 patients had no reproduction. The mean hospital stay was 29.45±3.98, and in patients without spondylodiscitöis it was 1.99±0.81, the two groups were significantly different from each other (p=0.0001).

Conclusion: Although most surgeons have a tendency to maintain antibiotic prophylaxis postoperatively or during hospitalization period, our study found that a single dose prophylactic antibiotic administered during anesthesia induction did not increase rate of spondylodiscitis by medical literature.

Keywords: Spondiylodiscitis, lumbar microdiscectomy, *Staphylococcus aureus*

INTRODUCTION

Although iatrogenic spondylodiscitis seen after lumbar disc surgery is very rare, its incidence has been reported by many different authors to be between 0.1-3% (1-15). Most articles on this topic are based on a retrospective case series. It is quite difficult to determine the true incidence of spondylodiscitis. Iatrogenic spondylodiscitis can be seen after discography, chemonucleosis, intradiscal operations (percutaneous laser disc decompression, nucleoplasty etc.), and lumbar disc hernia surgery. Although the infection rate in conventional discectomy is between 0.7% and 2.8%, there are authors who claim that this rate is higher in

ORCID IDs of the authors: F.D. 0000-0001-6169-9722; M.B.O. 0000-0003-0563-3221; H.C. 0000-0002-6792-9987; A.K. 0000-0003-2109-1274

Corresponding Author: Furkan Diren,
E-mail: furkandiren@yahoo.com

Received Date: 24.07.2018 **Accepted Date:** 24.07.2018

J Acad Res Med 2020;10(2):106-10

microdiscectomy (16). In addition, lumbar puncture, myelography and chemical sympathectomy can lead to distance contamination, causing discitis.

In terms of the development of spondylodiscitis, it is a matter of debate about whether the disc level is intra-operative contamination, from neighboring organs or hematogenous spread. The most common pathogen is *Staphylococcus aureus*. Diagnosis of spondylodiscitis is made by clinical laboratory and magnetic resonance imaging (MRI).

In some studies, despite adequate treatment for postoperative spondylodiscitis, the percentage of patients who could not continue under older study conditions was reported to be 66.7% and 87.5% (9,11,17), but only 44.6% of patients in a wide series of 7,493 surgeries and 90 spondylodiscitis has returned to their old professions (18). Prophylaxis is clearly important because of this negative result of postoperative spondylodiscitis. It is seen that perioperative intravenous antibiotics or irrigation with the antiseptic or antibiotic solution of the disc area are with irrigation is used, but postoperative spondylodiscitis has been significantly reduced (10,13).

The aim of this study is to define the incidence of spondylodiscitis in patients who underwent single-dose antibiotic prophylaxis under anesthesia induction and did not use prophylactic antibiotics in the postoperative period.

METHODS

Patient population and surgical technique: Medical records of 1,154 patients who were operated in our hospital between 2007 and 2015 due to a single or two-level lumbar disc hernia were retrospectively extracted. Patient consents were obtained. Five hundred fifty-four of these patients were female and 600 were male. Discectomy operation was performed in 1,062 of these patients with single level and 91 with two-level lumbar microsurgery. All patients were operated in prone position under general anesthesia in the operation room, and operated after sterile cover procedures. All patients underwent hemecircular laminectomy and foraminatomy and flavectomy to perform discectomy under the microscope. Attention was paid to hemostasis at the operation site and cartilage plates were not damaged, disc distance was not cured, but disc distances were irrigated with gentamicin serum at the end of the operation. All patients underwent a single dose of 1 g intramuscular cefazolin sodium antibiotic prophylaxis in accordance with the recommendations of the surgical antibiotic prophylaxis guidelines during anesthesia induction. During the 8-year follow-up period, 12 (1.03%) of the patients developed spondylodiscitis. Comorbidities, isolated pathogens, antibiotic susceptibilities, antibiotics used, and length of hospital stay were noted in the patients with spondylodiscitis.

Diagnosis of spondylodiscitis in the postoperative period: All patients were recorded by subtracting erythrocyte sedimentation rate (ESH) and complete blood count from the examinations performed before the operation. The first controls of the patients after discharge were made on the 15th day. MRI was performed on patients who had increasing back pain and/or leg pain in the postoperative period and applied to us again.

In cases such as ESH, white blood cell height at full blood count, hypointansity in the vertebrae adjacent to the disc operated on T1-weighted MRIs for control purposes in patients with high C-reactive protein (CRP) value, T2-weighted sections hyperintensity and contrast involvement in both end plates in contrast sections reduction of disc height; patients with clinical complaints and supporting laboratory findings was diagnosed with spondylodiscitis and hospitalized. After their hospitalization, tissue cultures were studied by taking a percutaneous biopsy from the disc distance and the pathogen was tried to be detected. Antibiotic infectious diseases, which are sensitive to patients with pathogen and antibiogram detected, were given as a result of consultation.

RESULTS

In our hospital, spondylodiscitis developed in 12 (1.03%) of 1,154 patients who had been operated for lumbar disc hernia and who underwent antibiotic prophylaxis during anesthesia induction only. The mean length of hospital stay at the time of operation was 1.99±0.81 days. Of the 12 patients diagnosed with spondylodiscitis, 7 were female and 5 were male. The mean age of these patients was 45.75±14.16 years. Eleven of these patients underwent a single level, 1 undervent two-level lumbar microdiscectomy. Five patients underwent microdiscectomy from L4-5 and 8 patients from L5-S1 levels. These patients were admitted to our outpatient clinic an average of 8.75±4.18 weeks after discharge, and a diagnosis of spondylodiscitis was made. Three of these patients had *S. aureus* (25%), 4 had *Staphylococcus epidermidis* (33%) and 3 had *Escherichia coli* (25%) and 2 patients had no reproduction. The patients were treated by the infection clinic, and the patients whose ESH and CRP values returned to normal under antibiotic treatment were discharged. The average hospital stay of these patients was 29.45±3.98 days, and in patients without spondylodiscitis 1.99±0.81 days, where the two groups were significantly different from each other (p=0.0001).

When the antibiotic susceptibilities of the bacteria obtained from cultures were examined, methicillin resistance was not detected in any of *S. aureus*, which reproduced in the tissue culture of 3 patients. In this case, it is sensitive to cefazoline given for prophylaxis. Methicillin resistance was observed in one of the *S. epidermidis* strains grown in 4 patients.

DISCUSSION

Postoperative spondylodiscitis is an unexpected condition with a rate of 0.1-3% that develops within 10 weeks after lumbar discectomy (10,19,20). Apart from lumbar disc surgery, as it can be seen in percutaneous procedures performed on the disc, discography, chemonucleosis, and ozone therapy, it is a severe complication due to its clinical course. Spinal instrumentation

J Acad Res Med 2020;10(2):106-10

surgery in addition to lumbar microdiscectomy is one of the factors that increase the risk of infection. In spinal surgeries, the incidence of spondylodiscitis is up to 35% in some studies (21,22).

In addition to the clinical and laboratory methods, MRI is an important and valuable tool for diagnosis. In MRI, it shows decreased bone signal on T1-weighted MRI, increased bone signal on T2-weighted MRI, and gadolinium involvement in end plates adjacent to the disc, disc area infection with a sensitivity of 93% to 96% and a specificity between 92% and 97% (17,23). In advanced cases, the decrease in the height of the disc distance and erosive appearances in the adjacent cortical bone can also be seen (18,19). Although these views show the value of the radiological study once again, these findings have been shown in all patients who developed spondylodiscitis in our study. Prior to the use of MRI, technetium 99m diphosphonate and gallium 67 citrate bone scintigraphy screening was considered as a reliable test to ensure early detection of disc space infections (8). However, today in most patients, lumbar MRI is sufficient to diagnose together with increased ESH and CRP values with clinical (18,24,25). Apart from MRI imaging, computed tomography may show narrowing of the disk space and erosion of the adjacent cortical bone (18,19).

Large series of spondylodiscitis have been published before the routine use of MRI (2,9,12,26). The incidence of disc space infection reported in these series is likely to be very low, because the sensitivity of radiography and tomography is lower than that of MRI, especially for the detection of postoperative spondylodiscitis during the first 6 weeks after surgery (23). In most studies, no information about duration was given for follow-up examinations (7,17,18). In our study, postoperative spondylodiscitis incidence was 1.03% with single dose antibiotic prophylaxis.

Some authors argue that percutaneous disc biopsy is effective in making a diagnosis (14,19,24,27). Tissue culture with a biopsy taken from the disc distance is very valuable in eradicating the pathogen causing spondylodiscitis. Although biopsy can be easily taken under tomography or under fluoroscopy, the reported complication rates are low, but there is also a high false negative rate (28-30). In our study, all patients who were hospitalized with the diagnosis of spondylodiscitis were performed discal biopsies and pathogen was detected and appropriate antibiotic treatment was initiated.

Postoperative spondylodiscitis is an infection of disc distance caused by skin flora contamination. Often causes are *S. aureus* and *S. epidermidis* (19,24,31) Fraser et al. (32) have suggested that "aseptic" spondylodiscitis likewise begins with the contamination of the disc space with potentially infectious pathogens. In these cases, the infectious process is usually self-limiting and does not lead to severe clinical symptoms, positive cultures, positive discal biopsies and increase in ESH and CRP (24,30). According to the literature, the incidence of postoperative spondylodiscitis is up to 3.0% in patients who do not receive antibiotic prophylaxis (2-4,9,11,33). Infection rates from 0% to 3.0% have been reported for macro-surgical approaches (2,3,9,16,21,34). Infection rate in patients undergoing microsurgery techniques ranged from 0% to 2.5% (5,6,16,35). The effect of microscope use on incidence in lumbar surgeries is also a matter of debate. While Kho and Steudel (35) reported that the infection rate increased from 0% to 2.5% after using the microscope, Dauch (16) observed that the infection rate decreased from 2.8% to 0.4%.

There are a limited number of articles on lumbar discectomy, postoperative spondylodiscitis as a result of spinal infections and the effects of prophylactic intravenous antibiotic use. In some series, with the use of gentamicin, first or second generation cephalosporins, the rate of postoperative spondylodiscitis has been reported as 0-0.5% (3,10). Horwitz and Curtin (36) focused only on wound infections and reported a significant reduction in infection rates after lumbar disc surgery in patients using

Table 1. Demographic factors (standard deviation)

Age (years, mean ± SD)	43.05±12.58
Gender (n, %)	
Male	600 (52%)
Female	554 (48%)
Level (n, %)	
L2-3	110 (8.8%)
L3-4	140 (11.2%)
L4-5	444 (35.6%)
L5-S1	505 (44.4%)
Multilevel (n, %)	91
Hospitalization duration (days, mean ± SD)	1.99±0.81

SD: Standard deviation

Table 2. Summary of patients who developed spondylodiscitis

Patient ID	Gender	Age	Level	Pathogen	Week of application
1	Female	65	L5-S1	*Staphylococcus aureus*	10
2	Male	40	L5-S1	*Staphylococcus epidermidis*	6
3	Female	39	L4-5, L5-S1	*Staphylococcus epidermidis*	6
4	Female	23	L5-S1	*Escherichia Coli*	4
5	Male	61	L5-S1	No reproduction	4
6	Female	49	L5-S1	*Staphylococcus aureus*	10
7	Male	26	L4-5	*Escherichia Coli*	14
8	Female	41	L5-S1	*Escherichia Coli*	13
9	Female	38	L5-S1	*Staphylococcus aureus*	2
10	Male	58	L5-S1	No reproduction	13
11	Female	44	L5-S1	*Staphylococcus epidermidis*	13
12	Female	65	L5-S1	*Staphylococcus epidermidis*	10

J Acad Res Med 2020;10(2):106-10

antibiotics. For spinal infection prophylaxis, a single dose of cefazolin sodium antibiotic is recommended for spinal surgery cases with or without instrumentation specified in the surgical guidelines (37). However, most surgeons tend to have patients use antibiotics in also postoperative period. The antibiotics used postoperatively can increase the antibiotic resistance of bacteria within the contaminated disc space. As a result of irrational antibiotic use, it can cause undesirable consequences such as cost, adverse effects, drug-drug interaction as well as antibiotic resistance. The incidence of spondylodiscitis in 1% of the patients we operated is within the values reported in the literature. Therefore, it was thought that the irrigation of the intervertebral disc distance in addition to a single dose of prophylactic antibiotics given to the patients was not caused by the insufficiency of the antibiotic given in terms of spectrum and duration. In our study, methicillin resistance was observed in only one patient in terms of antibiotic resistance when using single-dose antibiotics. Rational antibiotic use and antibiotic resistance are effective on the duration of spondylodiscitis treatment.

Washing the disc distance with antibiotic serums is a common practice among surgeons. However, there are few publications on this topic regarding the incidence of infectious complications after lumbar discectomy (38). In cases where the disc space cleaned after discectomy was irrigated with bacitracin and/or neomycin, the incidence of disc space infection was reported as between 0.2 and 1.2% (13). In cases where gentamicin, first or second generation cephalosporins are used, the incidence of postoperative spondylodiscitis has been reported between 0% and 0.5% (3,10,26). Gentamicin was used in irrigation fluid in our study. When we look at the sensitivities of organisms responsible for spondylodiscitis, 11 (91.6%) patients had sensitivity to gentamicin and cephalosporin. Gentamycin covers gram-positive and gram-negative bacteria, but can explain its effectiveness in preventing disc space infection.

In a study related to the topical applications of gentamycin, 72 patients who had osteomyelitis after orthopedic surgery, a collagenous sponge containing gentamicin was placed in the infected area and gentamicin levels in the drainage fluid were measured (31). Bactericidal gentamicin levels were found in the drainage fluid in the first 48 patients. It is possible to reach high antibiotic levels at the surgery area 72 hours after the operation. Based on these findings, in our study, the fact that the disc space infection is around 1% by irrigating the disc distance with a gentamicin solution may ensure that single dose antibiotic prophylaxis reaches bactericidal gentamicin and cephalosporin levels in the first postoperative days and is effective in preventing postoperative spondylodiscitis.

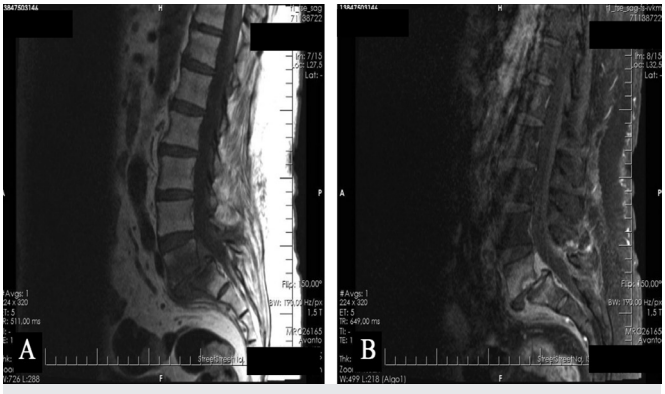

Figure 1. A) Image of discitis in L5-S1 level in T1A sagittal magnetic resonance (MR), **B)** image of discitis in L5-S1 level in contrasted T1A sagittal MR

Study Limitations

There are also limitations of our study. By its nature, it is a retrospective study based on patient file records. In our study, patients diagnosed with clinically advanced spondylodiscitis were examined, and those who were treated in subclinics or other clinics are not known. Although the patient population is not sufficient in terms of antibiotic resistance, objective results can be obtained by prospective studies.

CONCLUSION

Although most surgeons have a tendency to maintain antibiotic prophylaxis in the postoperative or in hospitalization period, our study shows that single dose prophylactic antibiotics performed only during anesthesia induction does not increase the rate of spondylodiscitis according to the medical literature.

Ethics Committee Approval: Retrospective study.

Informed Consent: It was obtained.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - F.D., M.B.O., H.C., A.K.; Design - F.D., M.B.O., H.C., A.K.; Supervision - F.D., M.B.O., H.C., A.K.; Resources - A.K.; Materials - A.K.; Data Collection and/or Processing - F.D., M.B.O., H.C., A.K.; Analysis and/or Interpretation - F.D., M.B.O., H.C., A.K.; Literature Search - M.B.O., A.K.; Writing - F.D., M.B.O., H.C., A.K.; Manuscript - S.D.; Critical Review - F.D., M.B.O., H.C., A.K.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. Andrews DW, Lavyne MH. Retrospective analysis of microsurgical and standard lumbar discectomy. Spine 1990; 15: 329-35.
2. Brussatis F. Osteomyelitis following surgery of the lumbar herniated disk. Acta Neurochir 1953; 3: 209-30.
3. Davis RA. A long-term outcome analysis of 984 surgically treated herniated lumbar discs. J Neurosurg 1994; 80: 415-21.
4. Ford LT, Key JA. Postoperative infection of intervertebral disc space. South Med J 1955; 48: 1295-303.
5. Goald HJ. Microlumbar discectomy: follow-up of 477 patients. J Microsurg 1980; 2: 95-100.
6. Kotilainen E, Valtonen S, Carlson CA. Microsurgical treatment of lumbar disc herniation: follow-up of 237 patients. Acta neurochir (Wien) 1993; 120: 143-9.
7. Meinig G, Kretzschmar K, Samii M, Wallenfang F, Hülse R, Schürmann K. Spondylodiscitis-Lumbar disc removal. Advances in Neurosurgery 2012; 4: 55-8.
8. Nolla-Sole JM, Mateo-Soria L, Rozadilla-Sacanell A, Mora-Salvador J, Valverde-Garcia J, Roig-Escofet D. Role of technetium-99m

J Acad Res Med 2020;10(2):106-10

diphosphonate and gallium-67 citrate bone scanning in the early diagnosis of infectious spondylodiscitis. A comparative study. Ann Rheum Dis 1992; 51: 665-7.

9. Pilgaard S. Discitis (closed space infection) following removal of lumbar intervertebral disc. J Bone Joint Surg Am 1969; 51: 713-6.
10. Piotrowski WP, Krombholz MA, Mühl B. Spondylodiscitis after lumbar disk surgery. Neurosurg Rev 1994; 17: 189-93.
11. Puranen J, Makela J, Lähde S. Postoperative intervertebral discitis. Acta Orthop Scand 1984; 55: 461-5.
12. Seifert V, Stolke D, Vogelsang H. Die postoperative discitis intervertebralis lumbalis. Aktuelle Neurologie 1983; 10: 161-6.
13. Tronnier V, Schneider R, Kunz U, Albert F, Oldenkott P. Postoperative spondylodiscitis: results of a prospective study about the aetiology of spondylodiscitis after operation for lumbar disc herniation. Acta Neurochir (Wien) 1992; 117: 149-52.
14. Thibodeau AA. Closed space infection following removal of lumbar intervertebral disc. J Bone Joint Surg Am 1968; 50: 400-10.
15. Stolke D, Sollmann WP, Seifert V. Intra-and postoperative complications in lumbar disc surgery. Spine 1989; 14: 56-9.
16. Dauch W. Infection of the intervertebral space following conventional and microsurgical operation on the herniated lumbar intervertebral disc a controlled clinical trial. Acta Neurochir 1986; 82: 43-9.
17. Frank AM, Trappe AE. The role of magnetic resonance imaging (MRI) in the diagnosis of spondylodiscitis. Neurosurgical Review 1990; 13: 279-83.
18. Stolke D, Seifert V, Kunz U. Die postoperative Discitis intervertebralis lumbalis. Z Orthop 1988; 126: 666-70.
19. Rawlings CE, Wilkins RH, Gallis HA, Goldner JL, Francis R. Postoperative intervertebral disc space infection. Neurosurgery 1983; 13: 371-6.
20. Dall BE, Rowe DE, Odette WG, Batts DH. Postoperative discitis. Diagnosis and management. Clin Orthop Relat Res 1987: 138-46.
21. Fernand R, Lee CK. Postlaminectomy disc space infection. A review of the literature and a report of three cases. Clin Orthop Relat Res 1986: 215-8.
22. Ebeling U, Reichenberg W, Reulen HJ. Results of microsurgical lumbar discectomy. Acta Neurochirurgica 1986; 81: 45-52.
23. Schulitz KP, Assheuer J. Discitis after procedures on the intervertebral disc. Spine 1994; 19: 1172-7.
24. Fouquet B, Goupille P, Jattiot F, Cotty P, Lapierre F, Valat JP, et al. Discitis after lumbar disc surgery. Features of "aseptic" and "septic" forms. Spine 1992; 17: 356-8.
25. Meyer B, Schaller K, Rohde V, Hassler W. The C-reactive protein for detection of early infections after lumbar microdiscectomy. Acta neurochir 1995; 136: 145-50.
26. Rohde V, Meyer B, Schaller C, Hassler WE. Spondylodiscitis after lumbar discectomy. Incidence and a proposal for prophylaxis. Spine 1998; 23: 615-20.
27. Scherbel AL, Gardner WJ. Infections involving the intervertebral disks. Diagnosis and management. JAMA 1960; 174: 370-4.
28. Armstrong P, Chalmers A, Green G, Irving J. Needle aspiration/biopsy of the spine in suspected disc space infection. Br J of Radiol 1978; 51: 333-7.
29. Babu NV, Titus V, Chittaranjan S, Abraham G, Prem H, Korula RJ. Computed tomographically guided biopsy of the spine. Spine 1994; 19: 2436-42.
30. Fraser R, Osti O, Vernon-Roberts B. Discitis after discography. J Bone Joint Surg Br 1987; 69: 26-35.
31. Gruss P, Tannenbaum H, Ott-Tannenbaum B, Tasler J, Spohr A, Gergart G. Die Verlaufsformen der Spondylodiszitis nach Bandscheibenoperation-zur Genese, Therapie und Prophylaxe. Neurochirurgia 1992; 35: 79-84.
32. Fraser R, Osti O, Vernon-Roberts B. Iatrogenic discitis: the role of intravenous antibiotics in prevention and treatment. An experimental study. Spine 1989; 14: 1025-32.
33. Bongartz EB, Ulrich P, Fidler M, Bernucci C. Reoperation in the management of post-operative disc space infection. Zentralbl Neurochir 1994; 55: 120-4.
34. Savitz MH. Minilaminotomy as an alternative to laminectomy or microdiskectomy: ten years' experience. Mt Sinai J Med 1991; 58: 165-7.
35. Kho HC, Steudel W. Vergleich der mikrochirurgischen lumbalen Bandscheibenoperation mit der konventionellen Technik beim frei sequestrierten Bandscheibenvorfall - Eine retrospektive Studie anhand von 267 Fällen. Neurochirurgia 1986; 29: 181-5.
36. Horwitz NH, Curtin JA. Prophylactic antibiotics and wound infections following laminectomy for lumber disc herniation. J Neurosurg 1975; 43: 727-31.
37. Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Surg Infect 2013; 14: 73-156.
38. von Hasselbach C. Clinical aspects and pharmacokinetics of collagen-gentamicin as adjuvant local therapy of osseous infections. Unfallchirurg 1989; 92: 459-70.