Implementation of the hemoprophylactic protocol in orthopedic surgery

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Abstract

Introduction: Antibiotic prophylaxis is defined as the use of antimicrobials in the absence of symptoms of infection, with the aim of preventing or reducing the incidence of infection after surgery. We analyzed the incidence of surgical wound infection in patients in whom a protection of hemoprophylaxis conducted using cefazolin and gentamicin, and determine the frequency of surgical wound infection in patients in whom there was a deviation in the implementation of hemoprophylaxis protection.

Methods: This retrospective-prospective study included 100 patients surgically treated at the The Department of Orthopedics and Traumatology, University Clinical Center in Tuzla from December 2007 to February 2010, which examined the incidence of surgical wound infection after surgical treatment of fractures or degenerative changes in the hip, thigh and lower leg fractures.

Results: In the first group, in patients who were treated with cefazolin were detected in 2 cases (5.7%) while the length of hemoprophylaxis was 7 days, patients who were treated with cefazolin and gentamicin were detected in 1 case (2.8%) and duration hemoprophylaxis was 7 days. In another control group tah was found 9 cases of wound infection (30%), and hemoprophylaxis duration was 10 days.

Conclusion: The combination of cefazolin and gentamycin for a period of 5 days significantly reduces the incidence of infection and significantly shortened the time of antibiotics in group that is respected application protocol in accordance with international recommendation.

Keywords: infections, orthopaedic, prophylaxis, antibiotic, cefazolin, gentamycin.

Introduction

Hemoprophylaxis is defined as the use of antimicrobial drugs in surgery in the absence of symptoms of infection, in order to prevent or reduce the incidence of infection of surgical wounds (1). After commencing of a therapy with antibiotics, one needs to define if there is a favorable clinical effect after the period of 24 to 72 hours. If the effect is present prophylaxis is terminated and if there isn't any effect the application of antibiotic continues, which is the antibiotic therapy. Antibiotic therapy is a continuous application of antimicrobial drugs after a surgery applied to prevent infections. Although it is considered that all the wounds resulting from injuries, as well as some surgical wounds, are contaminated with bacteria in most patients, the infection does not develop due to organism's defense capacity to eliminate microorganisms. Table 1 illustrates general and local risk factors which may affect an infection of a wound and which

TABLE 1. Factors associated with increased risk of surgical wound infection

General factors	Local factors
Diabetes	Foreign body
Use of corticosteroids	An injection of adrenaline
Obesity	Shaved area
Elderly population	Preliminary radiation of the surgical field
Malnutrition	Improper bending
Recent surgery	
Massive blood transfusion	Long-lasting surgery
Multiple comorbidities	Hemorrhage
ASA (American Society of Anesthesiologists) classification III-IV-V	

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TABLE 2. Causes of surgical wounds infections

Pathogen
Staphylococcus aureus
Coagulase-negative staphylococci
Enterococcus spp.
Escherichia coli
Pseudomonas aeruginosa
Enterobacter spp.
Proteus mirabilis
Klebsiella pneumoniae
Streptococcus spp.
Candida albicans

comply with the American Society of Anesthesiologists. The organism's defense capacity can be affected by the influence of general and local risk factors (2). Most surgical wound infections are caused by bacteria which form colonies in patients and which are a part of the patient's physiological flora or bacteria from the environment (3). The exception is patients hospitalized for a longer period of time who may be infected by multiple-resistant hospital pathogens (4). Infections may be caused by various pathogens. Table 2. ilustrates the most common pathogens encountered in orthopedic surgery. An antibiotic should affect the most common causes of surgical wound infections. The first generation of cephalosporins (cefazolin) is the first choice for all clean and most clean-contaminated wounds (where the main problem is bacterial contamination from the skin). It eliminates gram-positive bacteria which are the main causers of contamination from the skin. The second generation of cephalosporins (cefuroxime) is recommended in case of contamination with aerobic gram-negative pathogens while drugs with anti-anaerobic activity are recommended for contamination with anaerobic microorganisms. Vancomycin is applied when the cause of an infection is resistant to cephalosporins, such as methicillin-resistant staphylococcus aureus (MRSA-Methicillin-resistant Staphylococcus aureus) (5). The aim of this study was to determine the incidence of surgical wound infections in patients who received haemioprophylaxis with cefazolin and gentamicin and to determine the incidence of surgical wound infections in patients in whom discrepancies in the implementation of hemoprophylactic protocol occured.

Methods

The Department of Orthopedics and Traumatology of the Clinical Center in Tuzla conducted a retrospective-prospective study in the period from December 1, 2007 to February 28, 2010. It examined the incidence of surgical wound infections after surgical treatments of fractures or degenerative changes in the hip, thigh and lower leg fractures. Two groups were formed, a group of examined patients, and a control group and the total sample contained 100 respondents (patients) of both sexes.The first study group consisted of 70 respondents of both sexes older than 18, which wad divided into two sub-groups. The first sub-group consisted of 35 patients receiving cefazolin dose of 1 g twice a day preoperativelly during 4 postoperative days to prevent wound infection after a surgical treatment of fractures or degenerative changes in the hip, thigh and lower leg fractures. The second sub-group consisted of 35 patients receiving 2 grams of cefazolin for one preoperative day and the first postoperative day and receiving 120 mg of gentamicin twice a day during the second, the third and the fourth postoperative day for prevention of wound infection after surgical treatments of fractures or degenerative changes in the hip, thigh and lower leg fractures. The control group consisted of 30 respondents of both sexes older than 18 years of age, with a discrepancy in the implementation of hemoprophylaxis for the prevention of wound infection after a surgical treatment of fractures or degenerative changes in the hip, thigh and lower leg fractures.

Statistical analysis

A statistical analysis was performed with a program for biomedical applications called "MedCalc for Windows version 11.2.1", Copyright © 1993-2010 Frank Schoonjans. Numerical data were presented by measures of central tendency and dispersion of appropriate measures. Normality of distribution was checked by Kolmogorov-Smirnov test checking homogeneity of variance applied in F-test. To test the hypothesis of variability of the dependent variable and one independent factor (group) one applied one-way ANOVA for multiple independent groups and the Kruskall-Wallis test, if there was a discrepancy in the distribution of the dependent variable. To determine the frequency one

TABLE 3. Duration of hemoprophylactic therapy

	Hemoprophylactic Protocol		Deviation	
	Cefazolin n=35	Cefazolin+ Gentamycin n=35	Control n=30	*p* value
Duration of therapy (days)	7 (5-11)	5 2 days C + 3 days G	10 (7-15)	0.0001
Days spent in hospital	11.02	9.82	14.36	0.02

TABLE 4. Distribution of respondents by age and sex

		Hemoprophylactic Protocol		Deviation	
		Cefazolin n=35	Cefazolin+ Gentamycin n=35	Control n=30	*p* value
Age		45 (28-55)	47 (37-55)	62 (52-70)	0.0006
Sex	M	21	17	15	0.58
	W	14	18	15	

used Hi contingency 2 test. The results are presented in the tables. For statistically significant value p, one selected the usual level of significance p <0.05.

Results

In the first group of patients who were treated with cefazolin, there were 2 cases of infection (5.7%), while the hemoprophylaxis lasted 7 days. Infection occurred in 1 case (2.8%) in patients treated with and gentamycin while the hemoprophylaxis lasted 5 days. A statistically significant difference was found in the duration hemioprophylactic therapy. The control group of respondents was treated with antibiotics for 10 days, while treatments of other two sub-groups lasted shorter (p <0.05). The significant difference was defined in the length of hospitalization of the patients of the control group and it was 14.36 days, while it was 9.82 days in the second sub-group (p <0.05). The combination of cefazolin and gentamycin in a period of 5 days significantly reduces the incidence of infection. Mean length of hospitalization of the group terated by cefazolin and gentamicin was10 days, while it was 12 days for the group treated by cefazolin. Length of hospitalization of the group with a deviation from the hemioprphylactic protocol was 14 days. The minimum length of hospitalization was 3 days and maximum 22 days. Length of hospitalization was from10 to 15 days in most cases. Our results are similar to those in other countries from the region. A cooperation among orthopedists is necessary in order to properly determine hemoprophylactic protocol according to international recommendations. The significant difference is visible in the length of hospitalization (days spent in hospital) of the control group and it was 14.36 days and 9.82 days in the second sub-group (p < 0,05), which is ilustrated in Table 3. It is visible from table 4 that the age of respondents ranged from 28 to 70. Most of the respondents were male.

Discussion

Infections of surgical wounds represent a real problem in orthopedic surgery. Although considerable efforts have been made in recent decades (e.g. improvement of surgical techniques, preoperative preparation of surgical field, infection control, prophylactic use of antibiotics), infections are still occurring at surgical fields in the percentage of 0.5-2% of all patients after surgeries of fractures and implantation of endoprotetic material (6). Compliance with principles of a rational antibiotic therapy (haemoprophylaxis) plays an important role in the prevention of surgical wound infection. In the last two decades the number and duration of orthopedic surgeries have been increasing with implantation of endoprotetic material such as prosthesis (7). The number of infections of surgical wounds is increasing according to the increase of the number of surgical procedures and their complexity (8). Many studies tested significance of haemoprophylaxis. One of such studies was conducted in the Atlanta Center for Disease Control and Prevention. It is estimated that approximately 500,000 surgical infections occur annually in the United States (9). In the group which used haemioprophylaxis with cefazolin infection rate was 5.7% while in the group which used haemioprophylaxis with cefazolin and gentamicin it was 2 .8%. In the control group the percentage of infection was 30%. The accepted standard for postoperative infection should not exceed 1% (10).

Hemoprophylactic protocol is an important factor for prevention of post-operative infections and faster healing of patients. One defined a clinically significant difference in the presence of infections in patinets for whom hemoprophylactic protocol was not applied according to the international recommendations in regard to the patients for whom hemoprophylactic protocol was applied. The period of apllication of antibiotics was significantlly reduced in the group for which the application of hemopropilactiy protocol complied with the international recommendations.

Conslusion

The combination of cefazolin and gentamicin during the period of 5 days significantly reduces the incidence of infection. The length of application of antibiotic therapy and the length of hospitalization was significantly greater in the groups for which the hemoprophylactic protocol was not respected. Infections most commonly occured with operative treatments of the hip and were realted to age of patients, to the greatest number of operations in the surgical region and to duration of a surgery. There are not any significant differences in the occurrence of infection regarding patients' sex.

Conflict of interest

None to declare.

References

1. Šibalić S. Antimikrobna terapija starijih osoba. Tuzla: PrintCom d.o.o. Grafički inženjering Tuzla; 2010. 161-172 p.
2. Brown AR, Vicca AF, Taylor GJ. A comparison of prophylactic antibiotic regimens against airborne orthopaedic wound contamination. J Hosp Infect. 2001;48(2):117-121.
3. Garvin KL, Cordero GX. Infected total knee arthroplasty: diagnosis and treatment. Instr Course Lect. 2008;57:305-315.
4. Kirkland KB, Briggs JP, Trivette SL, Wilkinson WE, Sexton DJ. The Impact of Surgical-Site Infections in the 1990s: Attributable Mortality, Excess Length of Hospitalization, and Extra Costs. Infect Control Hosp Epidemiol. 1999; 20:725-30.
5. Fry DE. Surgical Site Infection: Pathogenesis and Prevention CME. 2003;2:23-25.
6. Meehan J, Jamali AA, Nguyen H. Prophylactic antibiotics in hip and knee arthroplasty. J Bone Joint Surg Am. 2009;91(10):2480-90.
7. Classen DC, Evans RS, Pestotnik SL, Horn SD, Menlove RL, Burke JP. The timing ofprophylactic administration of antibiotics and the risk of surgical-wound infection. N Engl J Med. 1992;326:281-6.
8. Tyllianakis ME, Karageorgos AC, Marangos MN, Saridis AG, Lambiris EE. Antibiotic prophylaxis in primary hip and knee arthroplasty comparision between Cefuroxime and 2 specific antystaphylococcal agents. J Arthroplasty 4. 2010:28-35.
9. Mody RM et all. Infectious complications of damage control orthopedics in war trauma. J Trauma. 2009;67(4):758-61.
10. Soldatović G, Milenković S, Mitković M, Bumbaširević M, Anđelković D, Milić D. Bone infections and antibiotic use in orthopaedics. Acta Fac Med Naiss. 2004;21(4):245-52.