Clindamycin — an Option for Antibiotic Prophylaxis In Arthroplasty

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Introduction: Generally joint arthroplasties, but especially hip arthroplasties, are perhaps the most widespread types of orthopedic surgeries. These types of interventions are special because of the possibility of bacterial complications occurring due to the implant.
Material and method: Between 2008–2009 a total of 48 patients were administered Clindamycin 600 mg iv, as antibiotic prophylaxis, specifying that administration was performed according to the international protocol. During follow-up we monitored the efficiency of perioperative antibiotic prophylaxis in patients by determining the C-reactive protein and the erythrocyte sedimentation rate.
Results: The patients' postoperative evolution at the site of the surgical wound presented no complications, except two cases of wound dehiscence caused by superficial hematoma which were subsequently solved with a secondary suture.
Conclusions: Clindamycin is used for preventive purposes especially in those protocols where beta-lactam allergy occurs. Clindamycin can also be used instead of cephalosporins in perioperative antibiotic prophylaxis. Our results are in accordance with those met in the speciality literature.

Keywords: Clindamycin, C-reactive protein, erythrocyte sedimentation rate, perioperative antibiotic prophylaxis

Introduction

Perhaps the most widespread orthopedic surgeries are joint arthroplasties and especially hip arthroplasties. These types of interventions are special because of the possibility of bacterial complications occurring due to the implant. The purpose of a prophylactic treatment with antibiotics is to reduce the rate of septic complications and to maintain it below 1%. Recently first generation cephalosporins are preferred in prophylaxis, although there is a danger that resistant strains of bacteria may occur. Clindamycin is an antibiotic that satisfies the requirements of perioperative prophylaxis and administered properly it can be used successfully in orthopedic surgery.

Patients with various orthopedic implants present an increased risk of bacteriological complications. Meehan [1] has brought into attention Moynihan's idea from the early twentieth century: „Each surgery is a bacterial experiment." Arthroplasties since the early 1970s experience an increased attention. Due to the presence of the implant are exposed to infection. In these cases the role of antibiotic prophylaxis is crucial [2,3]. Several authors have concluded that antibiotic prophylaxis reduces the absolute risk of postoperative infections [4,5,6].

Antibiotic prophylaxis can be defined as antibiotic treatment that prevents infections not present at the time of surgery but with real risk factors in the postoperative period [7,8]. This treatment reduces the number of bacteria at the surgery site during the operation and does not allow their colonization [7,8,9].

Bratzler et al. published in 2005 the properties of antibiotics used with prophylactic purposes: to stop protein production, which made up the cell wall, to inhibit folic acid and DNA precursors [7]. This way bacterial growth is inhibited, which has a bacteriostatic effect. Bactericidal antibiotic actually kills bacteria. It is known that low-dose bactericidal antibiotic is bacteriostatic, and vice versa the overdose of bacteriostatic antibiotic is bactericide [1].

When choosing an antibiotic for prophylactic purposes we have to take into account its pharmacokinetics and dynamics, antibacterial spectrum, toxicity and possible allergic reactions. The serum concentration of the used antibiotic should be higher, not the minimum inhibitory dilution, because there is a real danger of infection, and its half-life should be longer than the duration of surgery [1,7,10]. Parvizi et al. stated that an ideal antibiotic [21] should not be toxic, has good tissue penetration, is efficient against Staphylococcus aureus bacteria which are predominant in orthopedic infections.

A prophylactic antibiotic treatment lasts less than 24 hours after surgery and then it is interrupted [1,5,9,10]. After choosing the right antibiotic, the timing of its parenteral administration is imperative. The European Guide recommends the administration of the first dose at 30 minutes before incision [5,9]. While the U.S. Guide is more flexible regarding the time of administration; the interval between administration of antibiotics and incision can be extended up to 60 minutes [9,10].

Administration time must be followed strictly, because it is crucial. It is calculated by taking into consideration the half-life of the antibiotic serum. First generation cephalosporins are considered as standard, because they meet the requirements of prophylactic antibiotics and they are most commonly used [10,11,21,27].

Material and method

Between 2008–2009 we administered Clindamycin as antibiotic prophylaxis to 48 patients with primary hip arthroplasty. These patients were followed up until December 31, 2010, monitoring wound healing, changes in C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) values.

Table I. Timing, dosage and frequency of repetition in case of antibiotic prophylaxis

Antibiotics	Dosage	Timing	Repetition
Cefazolidin	1–2 g iv	30–60 minutes preoperatively	2–5 hours
Cefuroxim	1.5 g iv	30–60 minutes preoperatively	3–4 hours
Clindamycin	600–900 mg iv	30–60 minutes preoperatively	3–4 hours
Vancomycin	1 g iv	120 minutes preoperatively	6–12 hours

We administered Clindamycin 600 mg iv, as antibiotic prophylaxis, according to the international protocol developed by the American Academy of Orthopaedic Surgeons (AAOS)10 and patients were not selected based on betalactam allergy.

The distribution by gender was: 32 women and 16 men aged between 49 and 77 years (average age 64.8 years).

The etiopathogenesis of coxarthrosis where we practiced primary total hip arthroplasty was dominated by primary osteoarthritis, followed by Avascular Necrosis of the Femoral Head (AVNFH).

Based on medical histories we identified several predisposing factors of infection as associated pathologies. We stated that it was dominated by the presence of diabetes with obesity and smoking.

Results

Monitoring patients in terms of efficiency regarding perioperative antibiotic prophylaxis was performed by determining CRP and ESR. Both were determined 24 hours before surgery.

C-reactive protein is an acute phase protein with maximum peak values after 24–48 hours postoperatively. It can be used for the detection of complications occurring from the 4th postoperative day if its values do not decrease or after returning to normal (which happens after 3 weeks) when it can present a sudden increase. Results can be affected by associated pathology such as psoriasis. During our study we had three cases of psoriasis, which caused sterile inflammation.

ESR is also a sensitive but nonspecific marker of inflammation. Its values return to normal much later (6–12 weeks). If these examination values are interpreted together, their sensitivity and accuracy are much better [25,26]. The rate of CRP and ESR evolution was preoperatively 24 hours and postoperatively at 24 hours, 48 hours, 5 days, 21 days, respectively at 3, 6 and 12 months.

Discussion

Bacteriological infection of the surgical wound is a common complication and belongs to the group of nosocomial infections. There are data showing that this represents 25% of all nosocomial infections in surgical wards. This is the reason why one of the most feared complication of arthroplasties - periprosthetic deep infection occurs [7].

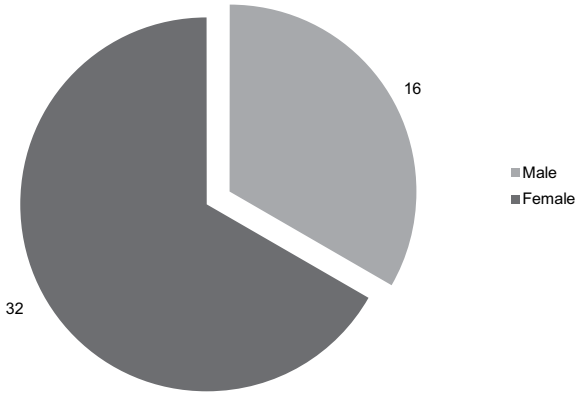

Fig. 1. Classifying patients by gender

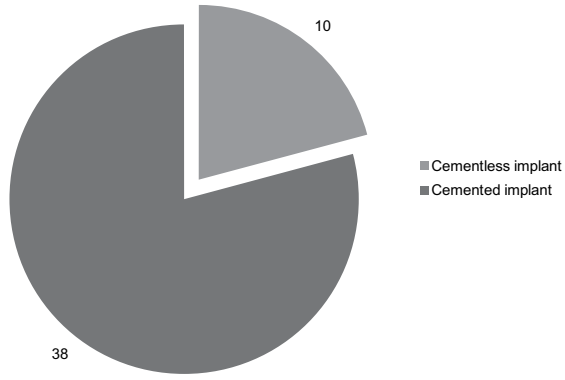

Fig. 2. Type of primary arthroplasty

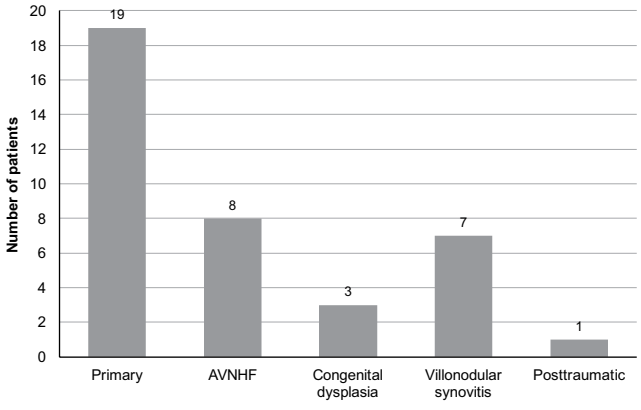

Fig. 3. Types of coxarthrosis

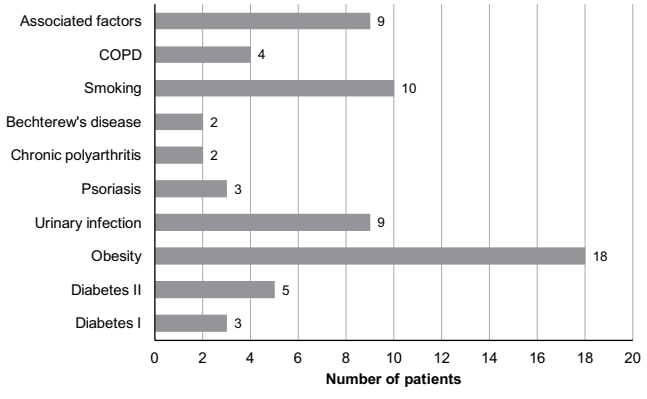

Fig. 4. Associated pathology, predisposing factors of infection

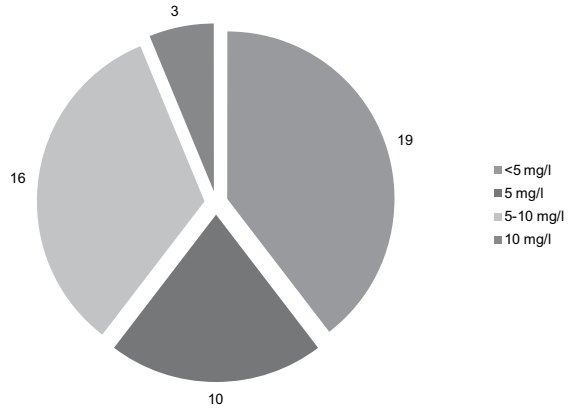

Fig. 5. Preoperative CRP values

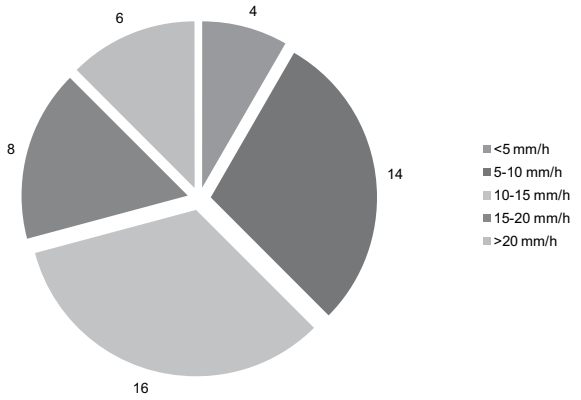

Fig. 6. Preoperative ESR values

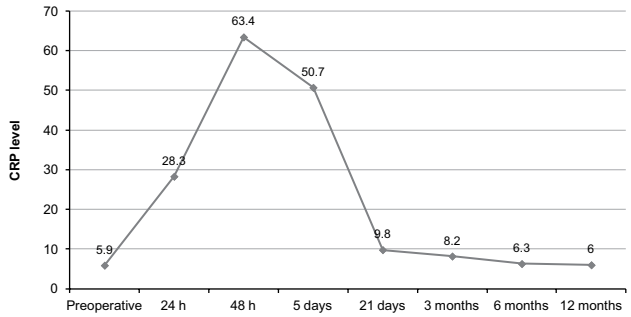

Fig. 7. Evolution of the average values of CRP

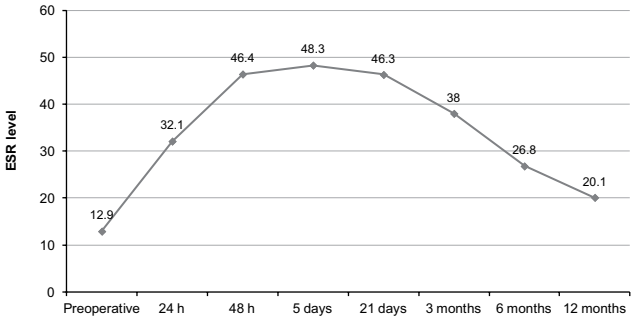

Fig. 8. Evolution of the average values of ESR

Patients having these complications of wound healing are five times more frequently re-hospitalized and their mortality rate is 2 times higher [7,10].

If peroperative antibiotic prophylaxis is administered the risk of wound infection is reduced by 81% [3,4,5,6].

AAOS 10 methodological letter issued in 2009 recommends the followings in case of antibiotic prophylaxis for joint arthroplasties:

1. The selection of antibiotics should be performed carefully according to bacterial sensitivity, possible allergic reactions and recommendations in the literature. Cephalosporins like Cefazolin and Cefuroxime are the most commonly used antibiotics. It also recommends a limited use of Clindamycin and only in exceptional cases of Vancomycin when the patient's allergic reaction to beta-lactams is obvious. The use of Vancomycin as prophylaxis is indicated only in those cases where the possibility of colonization on the implant with Methicillin-resistant Staphylococcus aureus (MRSA) is real. We should also be aware that the abusive use of Vancomycin increases the probability that E coli strains become resistant to it [10,12,21].
2. Timing and dosage are crucial. The time of first dosing is recommended to be at maximum 60 minutes before the incision [10,12], while the European protocol is more strict, allowing only 30 minutes before the incision [5,9]. In case of administering Vancomycin the time limit can be extended up to 120 minutes. These time limits are decided based on the biological half-life of the antibiotic serum. This is the cause that makes timing so important in case of these antibiotics. Table 1 shows the timing, dosage and frequency of repetition of antibiotic prophylaxis [2,10,11,12]. Repeated administration of these doses of antibiotics are recommended in two circumstances: when the period of surgical intervention exceeds the half-life of antibiotics or in case of a significant blood loss when transfusion is required [2,10,11,12,20].
3. This recommendation concerns the duration of prophylactic treatment with antibiotics. The period of treatment should not exceed 24 hours. In the specialty literature there are no data recorded about additional benefits regarding this type of treatment extended until

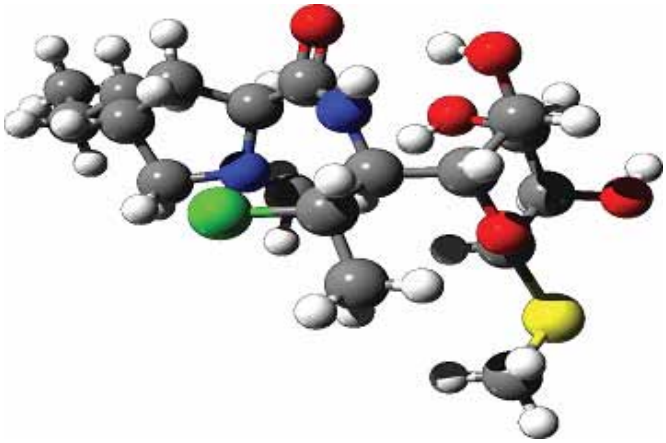

Fig. 8. Evolution of the average values of ESR

the removal of the drains [13,14,15,20]. If antibiotic prophylaxis is prolonged, it favors the occurrence of resistant strains and significantly increases the percentage of wound infections [20].

Starting from 2000 the specialty literature [16] draws attention to the slowly but steadily increasing percentage of infectious complications which is a multifactorial matter. Arthroplasties are performed in trauma units too, patients being hospitalized in the same room with emergency cases. The hospital management's trend to maintain the occupancy of beds >90% is also very important, this way nosocomial infections being favored. Surgical interventions have become an "industry" which have negative effects upon results, increased annual revisions cause increased infectious complications. However the most important factor is failing to comply to antibiotic prophylaxis management protocol [16,17].

Another problem is restarting prophylactic treatment with antibiotics for dental procedures. Presently it is proposed to restart antibiotic prophylaxis for dental maneuvers when the prosthesis has been implanted for less than two years, or the patient was immunocompromised or medical history reveals a treated periprosthetic infection. Correct timing and choice of antibiotic prophylaxis significantly reduces the rate of bacterial complications in orthopedic surgery. Clindamycin has a proper antibacterial spectrum, it has low toxicity and its half-life of serum concentration is long enough to be added to the list of antibiotics used for prophylactic purposes, it should not be used only in those cases when allergy to beta-lactams occurs. However it is recommended to use Clindamycin only in patients with unaffected renal function, those who present this disorder must be monitored [6,7]. The obtained results are comparable to those found in case of cephalosporins. In our group of patients we did not have any allergic or toxic reactions.

Conclusions

Clindamycin is used for prevention purposes especially in those protocols where beta-lactam allergy occurs. It is a constituent of a group of antibiotics called macrolides. Its 3D structure is represented in Figure 10. Clindamycin is a broad-spectrum antibiotic, which can be used in case of infections caused by Gramm-negative or Gramm-positive bacteria, and in some cases by anaerob bacteria too. Using Clindamycin confers protection comparable to cephalosporins.

Patients' postoperative evolution at the site of the surgical wound was without complicatians, except those two cases of wound dehiscence caused by superficial hematoma, which was solved with a secondary suture. When applying the secondary suture we reintroduced antibiotic prophylaxis for 24 hours using Clindamycin again.

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