



Overview of Implant Infections in Orthopaedics Department: Retrospective Study

Ortopedi Kliniğindeki Enfeksiyonların Gözden Geçirilmesi: Retrospektif Çalışma

Implant Infections

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Özet

Bu çalışmadaki amacımız ortopedik implant enfeksiyonlarında izole edilen bakterilerin antibiyotik duyarlılık paternlerini değerlendirmektir. Bu amaçla ortopedi ve travmatoloji kliniğinde 2 yıllık süre içerisinde ameliyat edilen 1996 hasta retrospektif olarak incelendi. 76 tanesinde (76/1996, 3.8%) ortopedik implant enfeksiyonu saptandı. Bu hastalardan izole edilen bakteriler ve bu bakterilerin antibiyotik duyarlılık paternleri incelendi. En fazla izole edilen bakteri Staphylococcus aureus (%30.3) idi. Hastaların %65.8'sinde gram negatif bakteriler izole edildi. Gram pozitif bakterilerde vankomisin ve linezolidde karşı direnç saptanmadı. Gram negatif bakteriler için imipenem, amikasin ve sefepimin en duyarlı antibiyotikler olduğu görüldü.

Anahtar Kelimeler

Ortopedik İmplant; Enfeksiyon; Antibiyotik Duyarlılığı

Abstract

In this study, our aim was to evaluate the antibiotic susceptibility of bacteria isolated from orthopedic implant infections. Within two years operated 1996 patients in an orthopedics and traumatology clinic were retrospectively investigated. Seventy-six (76/1996, 3.8%) orthopedic implant infections were detected. Isolated bacteria and their antibiotic susceptibility patterns were analyzed. The bacteria isolated from implant related infections and antibiotic sensitivity patterns were evaluated retrospectively in our orthopaedics and traumatology clinic. Staphylococcus aureus was the predominant organism (30.3%). Gram negative bacteria were isolated in 65.8% of our patients. No resistance was determined against vancomycin and linezolid in gram positive bacteria. Imipenem, amikasin and cefepim was seen as the most effective antibiotics for gram negative bacteria.

Keywords

Orthopaedic Implant; Infection; Antibiotic Susceptibility

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Introduction

Orthopaedic infections are the most frequently seen hospital infections [1]. These infections lead to a need for revision surgery, delayed wound healing, increased antibiotic use and prolonged hospitalisation [1]. The tendency of serious recurrences of orthopaedic implant infections causes high morbidity rates and a serious increase in the costs of treatment [2]. Bacterial biofilms which develop on the implant create a protective mechanism of host defence and antimicrobial treatment [3].

Implant infections are classified in 3 groups according to the source [4];

- During or immediately after the operation (perioperative)
- By the blood pathway
- By a proximity pathway

Symptoms are classified in 3 groups according to the time of onset [4];

- Early infection (<3months)
- Delayed or low-grade infection (3-24 months)
- Late infection (>24 months)

The aim of this study was to make a retrospective evaluation of infections which developed in patients who had orthopaedic implants, and the sensitivity of generally used antibiotics.

Material and Method

A retrospective evaluation was made of 1996 patients who underwent applications of partial or total joint prosthesis, plate, screw, external fixator or intramedullary nailing within a 2-year period at the Orthopaedics and Traumatology Clinic of our hospital. Prophylactic 1 g cephazoline was administered to all patients preoperatively. In patients who developed postoperative infections, the micro-organisms produced from wound site culture samples and antibiotic sensitivity status were retrospectively evaluated. In those with postoperative signs of macroscopic infection (joint pain, redness, fever, swelling or fistula discharge), routine microbiological evaluations were made of debridement or swab samples obtained from the patient and of bacteria colonisations on the fixation material taken with a curette. All the samples were taken under aseptic conditions and reached the laboratory without any contamination. Before taking the samples, it was attempted to prevent contamination with disinfectants such as povidone iodine or hydrogen peroxide. The laboratory evaluations were made with the standard laboratory procedures of gram staining, colony characteristics, traditional biochemistry tests and an automated identification and antibiogram system (BD Phoenix™ Automated Microbiology System, USA). Empiric cephalosporin therapy was given to all infected patients until culture and antibiotic susceptibility test results become available.

Results

Retrospective evaluation was made of a total of 1996 patients who underwent fracture fixation using fixation materials such as external fixator (114/1996, 5.7%), plate, screw or intramedullary nailing (1419/1996, 71.1%) or underwent arthroplasty surgery with partial or total joint prosthesis (463/1996, 23.2%). Mean age of patients was 52 years (range: 14-92 years). Fifty-five point six percent of patients were male (1109/1996), and 44.4% were female (887/1996). Of these patients, infection de-

veloped in 76, which was determined by bacterial proliferation in the obtained samples. Seventy-six patients were infected and 30 patients (30/76, 39.5%) were in plate, screw or intramedullary nail group, 21 patients (21/76, 27.6%) were in hemiarthroplasty or total arthroplasty group and 25 patients (25/76, 32.9%) were in external fixation group. The rate of infection development in 76 of 1996 patients was determined as 3.8%. Infection rate determined as 2.1% (30/1419) in plate, screw or intramedullary nail group, 4.5% (21/463) in hemiarthroplasty or total arthroplasty group and 22% (25/114) in external fixation group. Mean age of patients who underwent hemiarthroplasty or total arthroplasty was 71 years (range: 58-94 years) and at least one of comorbid factors (Diabetes mellitus, renal failure, hypertension or chronic obstructive pulmonary disease) were present in 91% of them. Mean age of patients with periprosthetic infection was 79 years (range: 67-88 years) and they all had at least one comorbid factor. The most commonly isolated bacteria were *Staphylococcus aureus* in 23 cases (30.3%) and *Pseudomonas aeruginosa* in 20 cases (26.3%), followed by *Acinetobacter* spp. in 10 (13.2%), *Escherichia coli* in 7 (9.2%), *Serratia marsescens* in 4 (5.3%), *Klebsiella pneumoniae* in 4 (5.3%), *Enterobacter cloacae* in 3 (3.9%), *Proteus mirabilis* in 1 (1.3%), *Enterobacter sakazaki* in 1 (1.3%), Coagulase negative staphylococcus in 2 (2.6%) and *Enterococcus* spp. in 1 (1.3%). In the gram positive bacteria, resistance to linezolid and vancomycin was not determined, while in the gram negatives, imipenem, amikacin and cefepime were determined as the most sensitive antibiotics. Isolated bacteria and antibiotic susceptibility patterns are detailed in table 1.

Discussion

Postoperative infection complications have been reported to be seen at rates of 1%-4%, and the rates are higher following revision surgery [5]. In the current study, the rate of infection developing in all the implants was determined as 3.8% at 76 of 1996 cases.

Treatment of infection increases the financial cost of the primary treatment 3-4-fold [5]. Better control of infection can be considered to have a positive effect on reducing treatment costs.

In a 15-year study by Phillips et al evaluating deep prosthetic infections, rates were reported of 0.57% (34/5947) following hip replacement and 0.86% (41/4788) following knee replacement [6]. In the current series of evaluations, of 463 patients with major joint partial or total arthroplasty, infection was determined in 21 (4.5%). Mean age of these patients was 79 years (range: 67-88 years) and at least one of comorbid factors (Diabetes mellitus, renal failure, hypertension or chronic obstructive pulmonary disease) were present in all of them. As patients undergoing arthroplasty are generally elderly with many comorbidity factors, the high rate of infection can be considered to be due to the need for a longer pre-operative and postoperative hospitalisation period.

In previous studies conducted in Turkey, of orthopaedic foreign body and prosthesis infections, the most frequently isolated bacteria was *Staphylococcus aureus* [7-8]. Kandemir et al reported rates of *Staphylococcus aureus* of 42% and Akhan et al of 48% [7-8]. In the current study, *Staphylococcus aureus* was

Table 1.

	Number	Percentage	Antibiotic Sensitivity																				
			Penicillin	Vancomycin	Erythromycin	Clindamycin	Trimethoprim – sulfamethoxazole	Linezolid	Ciprofloxacin	Chloramphenicol	Rifampicin	Gentamicin	Ampicillin	Cephalothin	Amoxicillin - clavulanate	Piperacillin - tazobactam	Ceftazidime	Aztreonam	Cefepime	Imipenem	Amikacin	Ceftriaxone	Netilmicin
Gram (+)																							
Staphylococcus aureus	(%)																						-
Coagulase negative Staphylococcus	2	2.6%	0	2	0	1	1	2	1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
Enterococcus spp.	1	1.3%	1	1	0	-	-	1	-	0	-	1	-	-	-	-	-	-	-	-	-	-	-
Gram (-)																							
Pseudomonas aeruginosa	20	26.3%	-	-	-	-	-	19	-	-	-	-	-	-	14	14	12	19	16	19	-	18	15
Acinetobacter spp.	10	13.2%	-	-	-	-	-	0	-	-	-	-	-	8	4	3	-	7	7	6	0	-	-
Escherichia coli	7	9.2%	-	-	-	-	-	3	-	-	-	0	1	5	4	-	-	4	7	7	2	-	-
Serratia marcescens	4	5.3%	-	-	-	-	-	4	-	-	-	0	0	4	4	-	-	4	4	4	4	-	-
Klebsiella pneumoniae	4	5.3%	-	-	-	-	-	3	-	-	-	0	2	2	4	-	-	3	4	4	2	-	-
Enterobacter cloacae	3	3.9%	-	-	-	-	-	3	-	-	-	1	1	2	2	-	-	3	3	3	2	-	-
Proteus mirabilis	1	1.3%	-	-	-	-	-	1	-	-	-	1	1	1	1	-	-	1	1	1	1	-	-
Enterobacter sakazakii	1	1.3%	-	-	-	-	-	1	-	-	-	0	0	0	0	-	-	1	1	1	0	-	-
TOTAL	76	100%																					

determined in 20 patients (30.3%). However, of all the infections, the majority (65.8%) were gram-negative based infections. In a study by Al-Maiyah et al, proliferation was determined at 9% in cultures taken from the gloves at 20-minute intervals during total hip arthroplasty surgery, and of the bacteria produced, 99% were reported to be gram-positive [9]. In long-term hospitalisation of bedridden patients with poor perianal care, gram negative contamination has been shown to be greater (74.7%) [10]. Khosravi et al determined mostly Staphylococcus aureus (21%) in orthopaedic implant infections, but overall, gram negative bacteria were isolated at a high rate of 66% [11]. The lower rate of gram positive bacteria determined in the current study can be thought to be due to insufficient postoperative care and patient compliance.

In orthopaedic implant surgery, antimicrobial prophylaxis in the surgical field has been helpful in reducing infections from 4-8% down to 1-3% [12]. One gram cephalosporin was used as prophylactic agent for all our patients. If guidance cannot be taken from the culture result in acute or chronic infections, vancomycin is the first treatment choice for gram positive bacteria and 3rd or 4th generation cephalosporins can be selected for gram negative bacteria [13]. In another study, vancomycin was recommended for gram positive bacteria and gentamycin for gram negative bacteria [5]. In the gram positive bacteria, resistance to linezolid and vancomycin was not determined, while in the

gram negatives, imipenem, amikacin and cefepime were determined as the most sensitive antibiotics. The finding in the current study that the sensitivity of S. aureus to vancomycin was higher than that of gram negative bacteria to imipenem and quinolone, is consistent with literature [11]. When administering prophylaxis until isolation of the agent, narrow spectrum antibiotics may be selected [14]. Cephazolin was used for empiric antibiotic treatment in our clinic until isolation of infectious agent. Evaluation of arthroplasty and trauma patients, open and closed fractures, primary and revision arthroplasties in same study was our limitation. However our primary aim was to evaluate the antibiotic susceptibility of isolated bacteria from orthopedic implant infections, therefore this limitation was ignored. In conclusion, knowledge of the majority of isolated bacteria and antimicrobial sensitivity patterns guides the choice of antibiotic. Despite all the precautions, it must be taken into consideration that there could be an increase in orthopaedic implant infections in long-term bedridden, elderly patients with poor personal care.

Competing interests

The authors declare that they have no competing interests.

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