

## Retrospective Study

Knowledge and attitudes of orthopedic surgeons regarding  
prosthesis joint infection

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Periprosthetic joint infection (PJI) is a critical complication after joint arthroplasty and is accompanied by increasing rates of morbidity and mortality. Several studies have aimed at preventing PJI.

**AIM**

To research the knowledge level and attitudes of orthopedic surgeons, who play a key role in both preventing and managing PJI.

**METHODS**

We conducted a web-based survey to evaluate orthopedic surgeons' knowledge level and attitudes regarding PJI. The Likert scale survey utilized consisted of 30 questions which were prepared based on the "Proceedings of the International Consensus on Periprosthetic Joint Infection".

**RESULTS**

A total of 264 surgeons participated in the survey. Their average age was 44.8, and 173 participants (65.5%) had more than 10 years of experience. No statistically significant relationship was found between the PJI knowledge of the surgeons and their years of experience. However, participants who worked in training and research hospitals demonstrated higher levels of knowledge than the ones in the state hospitals. It was also noticed that surgeons' knowledge concerning the duration of antibiotic therapy and urinary infections was not consistent with their

attitudes.

### CONCLUSION

Even though orthopedic surgeons have adequate knowledge about preventing and managing PJI, their attitudes might contradict their knowledge. Future studies are required to examine the causes and solutions of the contradictions between orthopedic surgeons' knowledge and attitudes.

**Key Words:** Antibiotic prophylaxis; Periprosthetic joint infection; Prevention; Total joint replacement; Turkey

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**Core Tip:** In this study, researching the knowledge level and attitudes of orthopedic surgeons, who play a key role in both preventing and managing prosthesis joint infections, has been aimed.

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## INTRODUCTION

Total joint replacement is the most frequently applied procedure in orthopedic surgery, and the prevalence of this surgery is increasing gradually. However, the number of periprosthetic joint infection (PJI) cases is also increasing in parallel with arthroplasties[1]. PJI is a critical complication after joint arthroplasty operations and is accompanied by higher rates of morbidity and mortality. Apart from increasing the cost of health services, the treatment of PJI is complicated, and patients generally need to undergo more than one major operation and receive antibiotic treatment to annihilate the infection. There have been several studies aimed at preventing PJI[2,3].

Gram-positive bacteria are the most seen pathogens in infected orthopedic prostheses, and 75% of the infections are caused by *Staphylococcus aureus* (*S. aureus*). The most frequently used antibiotics in total joint replacement (TJR) are cephalosporins and semi-synthetic penicillins. Routine prophylaxis is applied as a multi-cefazolin dose by many authors in clean surgical procedures including elective orthopedic surgeries. Most early postoperative infections are the result of intraoperative contamination of the surgical site[3-5].

Guidelines about preventing PJI are published by the International Consensus Meeting, World Health Organization (WHO), and the Center for Disease Control and Prevention, and these guidelines are updated regularly in parallel with the current practices and progression[6]. However, orthopedic surgeons' compliance with these principles might differ depending on their knowledge level, experience, and working conditions. In this research, the examination of the knowledge and attitudes of orthopedic surgeons in Turkey about preventing PJI has been aimed by means of a survey study.

## MATERIALS AND METHODS

This study was performed between January and March 2019. An online survey was conducted with orthopedic surgeons who were registered in the Turkish Society of Orthopedics and Traumatology in 2019 and who still performed hip arthroplasty. For this purpose, a total of 30 questions were prepared with the intent of providing an evaluation regarding orthopedic surgeons' knowledge about and attitudes towards PJI after joint prostheses. The questions were prepared based on the "Proceedings of the International Consensus on Periprosthetic Joint Infection"[7].

The survey consisted of questions that inquired about surgeons' demographical data, work experiences, features of the institution where they worked at the time of the study, annual arthroplasty numbers, and pre-surgical, intra-surgical, and post-surgical knowledge levels as well as attitudes regarding PJI. The demographic data and questions regarding surgeons' operations (attitudes of surgeons) were presented in the first section of the survey. The second section was allocated for the questions concerning how the operations should be done (knowledge). In the survey, the Likert scale was used. The study has been carried out in accordance with the principles of the Declaration of Helsinki.

### Statistical analysis

The data collected were analyzed using the software IBM SPSS version 22.0 (IBM Corp., Armonk, NY, United States). In order to statistically evaluate the data, descriptive statistics and analysis of variance (ANOVA) were utilized. The significance level was defined as  $P < 0.05$ .

## RESULTS

The total number of surgeons who participated in the survey was 264. Their average age was  $44.8 \pm 8.7$ , 173 participants (65.5%) had more than 10 years of experience, and 162 participants (61.4%) performed more than 50 TJR operations in a year (Tables 1 and 2). Whereas most of the participants were working in private hospitals (37.5%) at the time of the study, the number of participants who were working in a state hospital was smaller (24.6%) (Table 3).

Participants' answers to the questions that examined their attitudes towards PJI are presented in Table 4. Of the participants, 48.5% stated that they gave 2 g of cefazolin to every patient for surgical prophylaxis in arthroplasty operations. While 28.4% of them stated that they gave 1 g to every patient, 20.8% of them adjusted the dosage according to the patient's weight (Table 5).

Only one out of the total 264 participants stated that he/she did not change gloves during operation (0.4%). Whereas 20.5% of the participants said that they changed gloves once during an arthroplasty operation, 53% of them changed gloves twice, and 26.5% of them changed gloves three or more than three times. Of the participants, 54.9% noted that they changed their gloves when they were disintegrated, yet the rest reported that they did not change gloves. While 54.2% of the participants stated that they changed their gloves after contact with cement, the rest said that they did not change. Regarding the frequency, 38.6% of the participants stated that they changed their gloves every 1 h, while 9.5% changed their gloves every 90 min. More than half (59.5%) of the participants noted that they performed irrigation and debridement to the persistent drainage that continues more than 1 wk after the prosthesis operation, while the rest stated that they did not perform these. Just over a half (51.5%) of the participants pointed out that they administered antibiotic treatment, whereas the rest did not. Of the participants, 50.8% remarked that they discontinued anticoagulants, whereas the rest continued to administer anticoagulants.

While all participants finished the first section of the survey, 192 of them (73%) completed the second section. Participants' answers to the questions that examined their knowledge level in the second section are demonstrated in Table 6.

As a result of the ANOVA, it was determined that the knowledge levels of the participants did not differ in terms of their working period as an orthopedics and traumatology specialist ( $P = 0.483$ ) (Table 7).

In addition, the results of the ANOVA revealed that the knowledge levels of participants did not differ in terms of the number of performed operations per year ( $P = 0.675$ ).

When the average knowledge levels of the participants were examined according to the hospital types, it was seen that the knowledge level of those who worked in training and research hospitals (4.0403) was higher than the ones who worked in state hospitals (3.6580). The ANOVA also revealed that the knowledge levels of participants differed in terms of the type of hospital they currently worked in ( $P = 0.030$ ). In the post-hoc multi comparison test that was done to discriminate between which hospital types this difference occurred, it was determined that there was a significant difference in the knowledge levels between those who worked in training and research hospitals and the ones who worked in state hospitals (Table 8).

## DISCUSSION

The most important outcome of this study is the finding that the knowledge levels of the doctors who participated in the study are not congruent with their operations. While the most popular answer is that antibiotic therapy should not be continued longer than 24 h in mega-prosthesis operations, those who have stated that they give antibiotic treatment longer than 24 h construct the most crowded group. In recent survey studies, it has been reported that most orthopedic surgeons in Turkey do not follow antibiotic prophylaxis for TJR and administer antibiotic treatment longer than 24 h. This recent study has shown that orthopedic surgeons in Turkey have a good level of PJI knowledge, and antibiotics are used longer than 24 h in operations, which is in line with literature findings[6,8]. In addition, it has been reported in studies that 58% of the surgeons in Canada and 30% of the surgeons in Italy prefer antibiotic treatment that lasts longer than 24 h[9,10]. However, there is proof that antibiotic prophylaxis that is longer than 24 h is unnecessary and probably increases bacteria resistance[11]. We think that further studies are needed to determine why orthopedic surgeons in Turkey prefer antibiotic treatment that lasts longer than 24 h and to search for solutions to this issue. Another example of knowledge and attitude contradiction in this study is about urinary tract infections. While the most popular answer is 'urine tests should be ordered,' the majority of the participants have stated that they never order urine

**Table 1** Number of years as an orthopedic and traumatology specialist

	Frequency	%
< 5	37	14.0
5-10 yr	54	20.5
10-20 yr	104	39.4
> 20 yr	69	26.1
Total	264	100.0

**Table 2** Average number of arthroplasty operations per year

	Frequency	%
< 50	102	38.6
50-100	85	32.2
100-200	50	18.9
> 200	27	10.2
Total	264	100.0

**Table 3** Hospital type

	Frequency	%
State hospital	65	24.6
University hospital	53	20.1
Training and research hospital	47	17.8
Private hospital	99	37.5
Total	264	100.0

tests in clinical practice. With that being stated, according to up-to-date literature, while symptomatic urinary tract infection should be diagnosed and treated before PJI, routine tests and treatment are not suggested for asymptomatic bacteriuria since it has been reported that asymptomatic bacteriuria is not a risk factor for PJI. Routine tests and following treatment operations lead to unnecessary treatments[12]. In the survey study by Çimen *et al*[6], 59% of the participants perform a routine test prior to arthroplasty while 12% of them never perform it. Azboy *et al*[8] have found in their survey study that almost every surgeon who performs an arthroplasty operation more than 20 times a month orders routine urinary tests. These contradictory findings about urinary tract infections in our country might indicate that well-attended studies are required and that we do not have standardization in our country.

*S. aureus* is the agent that mostly causes surgical site infections besides many other infections[13]. The nasal colonization of *S. aureus* is around 25%, and the risk of surgical site infection increases in nasal methicillin-resistant *S. aureus* (MRSA) carriers. In addition to this, no consensus has been arrived at on the issue whether an MRSA scan should be done or not before TJR[10,14]. In this study, it has been noted that the majority of the orthopedic surgeons in Turkey have not performed routine tests.

It has been shown that skin cleaning before TJR surgery decreases the rate of PJI, and guidelines highly recommend skin cleaning before surgery. Chlorhexidine is reported as the most effective agent in this matter[15]. Çimen *et al*[6] have reported that half of the orthopedic surgeons in Turkey do not follow the recommendations related to skin cleansing before surgery. In the current study, while 44% of the participants stated that they never do chlorhexidine bathing, 35% of them maintained that they do it occasionally, and 30% of them always do it.

In a survey study conducted in Canada, it has been reported that most of the participants use 1 g of first-generation cephalosporin before TJR[9]. The literature promotes 2 g of first-generation intravenous cephalosporin dosage, which is higher, regarding antibiotic prophylaxis[16]. Besides, the American National Surgical Infection Prevention Project guideline group has determined that the dosage should be adjusted according to the weight of the patient[11]. Almost half of the participants (48.5%) in this study have stated that they administer 2 g of cefazolin.

**Table 4** Participants' answers to the questions that examine attitudes towards periprosthetic joint infection

	Never		Rarely		Occasionally		Frequently		Always	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Do you consult your patients to the dentist before total knee or hip arthroplasty?	94	35.6	61	23.1	61	23.1	21	8	27	10.2
Do you perform urine screening prior to elective arthroplasty of a patient with no symptoms of urinary tract infection?	119	45.1	25	9.5	22	8.3	21	8	77	29.2
Do you delay elective arthroplasty of asymptomatic patients with bacteriuria?	186	70.5	14	5.3	29	11	14	5.3	21	8
Do you screen your patients for nasal MRSA carriage prior to elective arthroplasty?	179	67	28	10.6	20	7.6	9	3.4	28	10.6
Do you recommend chlorhexidine bathing to your patients before elective arthroplasty?	117	44.3	15	5.7	35	13.3	19	7.2	78	29.5
Do you administer surgical prophylaxis in the second stage of the two-stage revision surgery?	10	3.8	0	0	13	4.9	10	3.8	231	87.5
Do you pay attention to the fact that the prophylaxis agent covers the patient's previously isolated prosthetic infection agent?	11	4.2	2	0.8	9	3.4	16	6.1	226	85.6
Do you administer surgical prophylaxis for a mega prosthesis (TM prosthesis) longer than 24 h?	40	15.2	8	3	27	10.2	26	9.8	163	61.7
Do you have your patients wear a mask during arthroplasty surgery?	214	81.1	15	5.7	14	5.3	5	1.9	16	6.1

MRSA: Methicillin-resistant *Staphylococcus aureus*.

**Table 5** Prophylaxis agent and dosage used in arthroplasty operations

	Frequency	%
1 g of cefazolin	75	28.4
2 g of cefazolin	128	48.5
I adjust cefazolin according to the patient's weight.	55	20.8
Gentamicin	1	0.4
Other	5	1.9
Total	264	100.0

The knowledge and attitudes of the participants regarding the subject of performing prophylaxis surgery in the second stage of the two-stage revision surgery and the subject of paying attention to the fact that the patient's agent of prophylaxis covers the patient's previously isolated prosthetic infection agent been consistent.

New algorithms are being presented to orthopedists related to complication protection, diagnosis, and treatment in TJR practices at regular intervals[17]. However, different attitudes emerge in applying these algorithms due to factors such as the experiences of orthopedists and the opportunities provided by the hospital they work in, which results in the discussion of these differences in studies[6,8-10]. In the present study, it has been determined that there is a significant knowledge level difference between participants who work in training and research hospitals and those who work in state hospitals, and surgeons who work in training and research hospital have higher knowledge levels. Discussing the guidelines that are created to prevent PJI and the standardized protocols in courses and congresses in detail might be beneficial in raising awareness as well as in generating documents for this field.

There have been some restrictions in this study. Even though the types of institutions are questioned, there has not been data concerning the geographical distribution and the location of the hospitals in Turkey. In addition, although our survey was composed of two sections, 27% of the participants did not complete the second section.

**Table 6** Participants' answers to the questions that examine their knowledge

Participants' answers	Never		Rarely		Occasionally		Frequently		Always	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
The patient should consult the dentist before total knee or hip arthroplasty	20	7.6	37	14	63	23.9	15	5.7	57	21.6
A urinary test should be ordered for the patient with dysuria complaint during the preoperative stage of an arthroplasty operation	33	12.5	22	8.3	29	11	13	4.9	95	36
Surgical prophylaxis should be administered in the second stage of a two-stage revision surgery	16	6.1	2	0.8	5	1.9	11	4.2	158	59.8
Prophylaxis agents should involve the factor of previously isolated prosthesis infection	9	3.4	2	0.8	4	1.5	6	2.3	171	64.8
Gloves should be definitely changed after contact with cement	14	5.3	10	3.8	26	9.8	25	9.5	117	44.3
For the diagnosis of prosthesis infection, 3-5 culture samples should be obtained	11	4.2	5	1.9	19	7.2	20	7.6	137	51.9
Irrigation and debridement should be applied to the patient in case of persistent drainage that continues more than 1 week after the total hip and knee arthroplasty operation	19	7.2	21	8.0	51	19.3	16	6.1	85	32.2
Surgical prophylaxis should not be longer than 24 hours for a mega prosthesis	52	19.7	18	6.8	43	16.3	11	4.2	68	25.8
The risk of infection increases as the duration of surgery gets longer	4	1.5	3	1.1	4	1.5	3	1.1	178	67.4

**Table 7** Comparison of participants' knowledge level and work experience

	<i>n</i>	Mean	Standard deviation	Standard error
< 5	21	3.7143	0.71277	0.15554
5-10 yr	42	3.8829	0.52707	0.08133
10-20 yr	74	3.9032	0.54305	0.06313
> 20 yr	55	3.7924	0.60175	0.08114
Total	192	3.8464	0.57638	0.04160

**Table 8** Comparison of participants' knowledge level and type of hospital they work in

Hospital type (I)	Hospital type (J)	Mean difference (I-J)	Standard error	Significance
State hospital	University hospital	-0.21482	0.12318	0.304
	Training and research hospital	-0.38234 <sup>1</sup>	0.13071	0.020
	Private hospital	-0.21535	0.10486	0.172
University hospital	State hospital	0.21482	0.12318	0.304
	Training and research hospital	-0.16752	0.13730	0.615
	Private hospital	-0.00053	0.11296	1.000
Training and research hospital	State hospital	0.38234 <sup>1</sup>	0.13071	0.020
	University hospital	0.16752	0.13730	0.615
	Private hospital	0.16699	0.12113	0.514
Private hospital	State hospital	0.21535	0.10486	0.172
	University hospital	0.00053	0.11296	1.000
	Training and research hospital	-0.16699	0.12113	0.514

<sup>1</sup>The mean difference is significant at the 0.05 level.

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## CONCLUSION

Even though orthopedic surgeons have enough knowledge about preventing and managing PJI, their attitudes might contradict their knowledge. Future studies that examine the causes and solutions of contradictions between orthopedic surgeons' knowledge and attitudes are required.

## ARTICLE HIGHLIGHTS

### **Research background**

Periprosthetic joint infection (PJI) is a critical complication after joint arthroplasty and increases morbidity and mortality. There have been several studies aimed at preventing PJI.

### **Research motivation**

The treatment of PJI is difficult, and patients generally need to undergo more than one major operation and receive antibiotic treatment to annihilate the infection. Therefore, PJI also increases the cost of health services.

### **Research objectives**

In this study the examination of knowledge about and attitudes toward preventing PJI of the orthopedic surgeons who work in Turkey has been aimed by means of a survey study. A good understanding of orthopedic surgeons' knowledge and attitudes about preventing PJI may guide new interventions to prevent PJI.

### **Research methods**

A web-based 30-question survey was conducted in order to evaluate orthopedic surgeons' knowledge level about PJI and their attitudes towards it.

### **Research results**

The knowledge and practices of surgeons regarding the duration of antibiotic treatment and urinary tract infections in prosthesis operations are different in Turkey.

### **Research conclusions**

This study has shown that even though orthopedic surgeons have got enough knowledge about preventing and managing PJI, their attitudes might contradict their knowledge.

### **Research perspectives**

The knowledge and attitudes of orthopedic surgeons may be different in practice. Future research that examines the causes and solutions concerning the contradictions between orthopedic surgeons' knowledge and attitudes are needed.

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## FOOTNOTES

**Author contributions:** Aytekin MN and Hasanoglu I designed the manuscript and collected the data; Öztürk R performed the data analysis and wrote the manuscript; Tosun N contributed by critically reviewing the manuscript; and all authors have read and approved the manuscript.

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