

# Unplanned Readmission After Total Joint Arthroplasty: Retrospective Cross-Sectional Survey

## Total Eklem Artroplastisi Sonrası Plansız Olarak Tekrar Hastaneye Başvurma: Retrospektif Kesitsel Çalışma

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**ABSTRACT Objective:** Total joint arthroplasty (TJA) is an effective surgical procedure for patients with end-stage osteoarthritis who have failed conservative treatments, demonstrating significant pain relief and improved physical function. Despite the clinical success of TJA, unplanned readmissions to hospitals after discharge are common, costly, and often preventable. This study aimed to determine the rates, reasons, and risk factors for readmission after TJA. **Material and Methods:** In this descriptive, retrospective study, we analyzed data from an electronic medical database for all patients who underwent total hip arthroplasty and total knee arthroplasty at one institution from January 2017 to July 2018. A total of 440 patients were included. Bivariate logistic regression was used to determine the risk factors of readmission within one year. **Results:** The readmission rate was 34.3% within one year. The most common reasons for readmission were pain related to the surgical procedure, the limitation of movements, and swelling at the surgical site. Other reasons were respiratory problems and cough, sputum and fever resulting in infectious complications in the current study. Furthermore, logistic regression analysis showed that patients with some comorbidities (rheumatoid arthritis, venous insufficiency, chronic obstructive pulmonary disease, atherosclerotic heart disease and, Alzheimer's disease) were found to have a higher risk of readmission within one year of discharge. **Conclusion:** The high readmission rates commonly is due to postoperative problems associated with TJA. These results suggest that the reasons of readmission are not easily preventable. It is thought that the patients undergoing TJA can need a holistic approach to care, discharge education, home monitoring, and follow-up to reduce and prevent unplanned readmission.

**ÖZET Amaç:** Total eklem artroplastisi (TEA), konservatif tedavileri başarısız olan son dönem osteoartritli hastalar için önemli ölçüde ağrıyı dindiren ve fiziksel fonksiyonu artıran etkili bir cerrahi prosedürdür. TEA'nın klinik başarısına rağmen taburcu olduktan sonra hastanelere plansız yeniden başvurular yaygın, maliyeti artıran ve çoğu zaman önlenilebilir bir durumdur. Bu çalışma, TEA sonrası yeniden hastaneye başvuru oranlarını, nedenlerini ve risk faktörlerini belirlemeyi amaçlamaktadır. **Gereç ve Yöntemler:** Bu tanımlayıcı retrospektif çalışmada, Ocak 2017-Temmuz 2018 tarihleri arasında bir kurumda total kalça ve diz artroplastisi uygulanan tüm hastaların elektronik tıbbi veri tabanındaki verileri analiz edilmiştir. Toplam 440 hasta dâhil edilmiştir. Taburculuk sonrası 1 yıl içinde yeniden hastaneye başvurunun (rutin kontrol dışı nedenlerle) risk faktörlerini belirlemek için 2 değişkenli lojistik regresyon analizi kullanılmıştır. **Bulgular:** TEA sonrası 1 yıl içinde yeniden hastaneye başvuru oranı %34,3'tür. Yeniden hastaneye başvurunun en yaygın nedenleri cerrahi işlemle ilgili ağrı, hareket kısıtlılığı ve cerrahi bölgede şişlik olarak bulunmuştur. Diğer başvuru nedenleri ise enfeksiyöz komplikasyonlara neden olan solunum problemleri, öksürük, balgam ve ateş olarak bulunmuştur. Ayrıca lojistik regresyon analizi, bazı komorbiditeleri (romatoid artrit, venöz yetersizlik, kronik obstrüktif akciğer hastalığı, aterosklerotik kalp hastalığı ve Alzheimer hastalığı) olan hastaların taburculuktan sonraki 1 yıl içinde yeniden hastaneye başvurma riskinin daha yüksek olduğunu göstermiştir. **Sonuç:** Yüksek yeniden başvuru oranları genellikle TEA ile ilişkili postoperatif sorunlardan kaynaklanmaktadır. Bu sonuçlar, yeniden başvuru nedenlerinin kolayca önlenilebilir olmadığını göstermektedir. TEA geçiren hastaların plansız yeniden başvurularını azaltmak ve önlemek için bakım, taburculuk eğitimi, evde izleme ve takip için bütüncül bir yaklaşıma ihtiyaç duyabilecekleri düşünülmektedir.

**Keywords:** Arthroplasty; readmission; risk factors; pain; total hip arthroplasty; total knee arthroplasty

**Anahtar Kelimeler:** Artroplastisi; yeniden başvuru; risk faktörleri; ağrı; total kalça artroplastisi; total diz artroplastisi

Total joint arthroplasty (TJA) is a clinically effective treatment for end-stage osteoarthritis of the hip or knee, providing pain relief and return of joint

function for most patients. Total hip and knee replacement surgery are the most common orthopedic surgery procedures.<sup>1-3</sup> The number of TJA procedures

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Peer review under responsibility of Türkiye Klinikleri Journal of Medical Sciences.

**Received:** 28 Nov 2020

**Received in revised form:** 23 Jun 2021

**Accepted:** 25 Jul 2021

**Available online:** 16 Aug 2021

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has increased rapidly since 2000 in most countries. By 2030, more than 500,000 total hip arthroplasties (THAs) and 3,000,000 total knee arthroplasties (TKAs) are expected to be performed annually in the United States.<sup>4</sup> According to Organization for Economic Cooperation and Development data; Switzerland, Germany, Austria, and Belgium had the highest rates for both hip and knee arthroplasties. The THA rate in Switzerland is 308 people per 100,000 of the population and TKA 240 people per 100,000 of the population. The THA rate in Turkey is 44 people per 100,000 of the population and TKA 67 people per 100,000 of the population.<sup>5</sup> With this growth in TJA, there are concerns about an overwhelming workload for the medical community and an increasing financial burden for society.<sup>2,6</sup>

Despite the clinical success of TJA, major complications associated with surgery occur, leading to prolonged hospitalization, increased costs, hospital readmission, and even reoperation.<sup>3,7</sup> Unplanned readmission to hospital is a quality measure of health care and is a serious, common, and costly patient outcome. Effective communication between health care providers and patient discharge education programs and post-discharge care must be established for the minimization of readmission.<sup>8,9</sup> Forster et al.'s study showed that one in five hospitalizations is complicated by post discharge adverse events, some of which may lead to preventable emergency department visits and readmissions.<sup>10</sup> Despite this, hospital discharge procedures for patients with TJA have not been standardized. Patients experience problems such as pain, impaired mobility, and inability to undertake daily living activities postoperatively resulting in patients with TJA being likely to be readmitted to the hospital.<sup>2,11</sup>

Previous studies have investigated healthcare costs associated with readmission following TJA.<sup>12-14</sup> However few studies have attempted to reasons of readmission commonly within 30 days or 90 days after surgery.<sup>4,15,16</sup> To our knowledge, this is the first study of its kind in Turkey. Understanding the rates, reasons, and risk factors for readmission within one year of surgery will allow health professionals to develop practice most likely to reduce rates of readmission.

## MATERIAL AND METHODS

In this retrospective cross-sectional survey, we analyzed data from an electronic medical database relating to all patients who underwent THA or TKA (ICD-10 code M.16 and M.17, respectively) at one university hospital located in the capital city of Turkey. The data were used to identify those patients who underwent THA or TKA between January 1, 2017 and July 31, 2018 and those readmitted within one year of surgery. A total of 500 patients who underwent primary arthroplasty were identified. These data were analyzed between July and September 2019. The study follows the Strengthening the Reporting of Observational studies in Epidemiology checklist.<sup>17</sup> Furthermore, planned discharge training is not provided for TJA patients in the hospital where the data are collected. Only one-page information brochure is given to patients.

## RESEARCH QUESTIONS

- What is the readmission status of patients with TJA?
- What is the relationship between modifiable patient-related factors or organizational factors and readmission rates after TJA?

## ETHICAL CONSIDERATIONS

All procedures followed were in accordance with the ethical standards of the responsible committee and with the Helsinki Declaration of 1975, as revised in 2013. This study was approved by the Non-interventional Clinical Research Ethics Committee (No. GO2019/09-50). The permission was received from the hospital (No. 20196593-2478). In addition, this article does not contain any studies with animals performed by any of the authors. As a large database study, informed consent was waived for this study.

## PARTICIPANTS

A total of 500 patients who underwent arthroplasty were identified. While selecting the patients, the reasons for arthroplasty such as osteoarthritis, necrosis, trauma, etc. were ignored. Revision THAs and TKAs (47 patients) and bilateral THAs and TKAs (13 patients) were excluded. Additionally, planned readmissions (e.g. postoperative routine control) were also excluded. After exclusion, there were 440 patients (THA 24 and TKA 416) available for statistical analysis.

## DATA COLLECTION

Data were collected from the electronic medical database using a Personal Information Form (PIF) and a Readmission Form. These forms were developed by researchers based on the literature after obtaining an expert opinion.

The PIF consists of 12 items related to socio-demographic characteristics (age, gender, comorbidities, residence place etc.).

The Readmission Form consists of 12 items (surgical procedure, postoperative complications, stay in intensive care unit, length of hospitalization, admission to hospital in post discharge period etc.).

## STATISTICAL ANALYSIS

The data were analyzed using IBM SPSS Statistics for Windows, version 23.0 (released 2016; Armonk, NY: IBM Corp.). The percentage, frequency and mean±standard deviation of each parameter were calculated. Categorical measures were summarized using counts and percentages, where continuous measures were summarized using means and standard deviations. To identify risk factors for readmission, logistic regression models for readmission status were conducted to calculate the odds ratio for each patient or clinical variable of interest.

## RESULTS

In our analysis of the data from the institutional electronic medical database for the patients who underwent TJA at one institution identified 440 patients. There were 151 readmissions after discharge following TJA.

**Table 1** summarizes the demographic characteristics of the included patients. The mean age of the total study sample of patients was 67.7±8.4 years and most were female (86.1%). Patients who underwent TKA comprised 94.5% of the sample and more than 3 in 4 patients had comorbidities (82.7%). Half of the patients in the sample were hospitalized for more than 5 postoperative days (50.5%) and 63% lived in the same city as the hospital where they had surgery. The readmission rate was 34.3%.

**Table 2** reports the outpatient clinic attendance of patients after discharge. After discharge from the

**TABLE 1:** Descriptive characteristics of the patients.

Descriptive characteristics	Number (n=440)	%
<b>Gender</b>		
Woman	379	86.1
Men	61	13.9
<b>Surgical procedure</b>		
TKA	416	94.5
THA	24	5.5
<b>Comorbidities</b>		
Yes	364	82.7
No	76	17.3
<b>Postoperative complications</b>		
Yes	20	4.5
No	420	95.5
<b>Postoperative stay in intensive care unit</b>		
Yes	5	1.1
No	435	98.9
<b>Length of hospitalization</b>		
1-2 days	4	0.9
3-4 days	214	48.6
5+ days	222	50.5
<b>Residence place</b>		
The city where the hospital located	277	63.0
A different city	163	37.0
<b>Readmission status</b>		
Yes	151	34.3
No	289	65.7

TKA: Total knee arthroplasty; THA: Total hip arthroplasty.

hospital, 69.1% of the patients attended the orthopedic outpatient clinic once and 8% attended twice.

There were many unique reasons for readmission after TJA and the most common reasons for readmissions after discharge, grouped according to outpatient clinics, are presented in **Table 3**. The most common reasons were pain related to the surgical procedure, the limitation of movement and swelling at the surgical site. Other reasons were respiratory problems and cough, sputum and fever resulting in infectious complications in the current study.

**Table 4** summarizes the most common outcome of readmissions after discharge: 23% of the patients who were readmitted to the hospital were prescribed oral analgesics and non-steroid anti-inflammatory drugs (NSAIDs) and discharged. Two percent of the patients who were readmitted needed revision of the prosthesis due to periprosthetic joint infection (3 pa-

**TABLE 2:** Outpatient clinics admitted to patients after discharge.

Outpatient clinics	Readmission status (n=440)			
	Yes Number	%	No Number	%
Orthopedic*	304	69.1	101	23.0
Emergency	13	3.0	427	97.0
Chest diseases	4	0.9	436	99.1
Nephrology	2	0.5	438	99.5
Pain unit	4	0.9	436	99.1
Cardiology	5	1.1	435	98.9
Rheumatology	5	1.1	435	98.9
Endocrinology	1	0.2	439	99.8
Cardiovascular surgery	2	0.5	438	99.5
Urology	3	0.7	437	99.3
Physiotherapy	3	0.7	437	99.3

\*35 patients (8%) attended to the orthopedic outpatient clinic twice.

**TABLE 3:** The most common reasons for readmissions after discharge.

Clinics	Reason	Reason for readmission (n=440)		Readmission time (postoperative days) ( $\bar{X}$ )
		Number	%	
Orthopedics	Pain	88	20.0	21.9
	Pain and the limitation of movement	17	3.9	
	Pain, swelling and the limitation of movement	9	2.0	
Emergency	Pain	5	1.1	1.4
	Pain and the limitation of movement	2	0.5	
	Respiratory problems	2	0.5	
Chest diseases	Cough, sputum and fever	2	0.5	1.3
	Dyspnea	1	0.2	
	Apnea	1	0.2	
Nephrology	Anuria	1	0.2	0.2
	Edema	1	0.2	
Pain unit	Severe pain	4	0.9	1.3
Cardiology	Tachycardia	1	0.2	1.04
	Bradycardia	1	0.2	
	Chest pain	1	0.2	
Rheumatology	Severe pain	5	1.1	1.09
Endocrinology	Blood sugar irregularity	1	0.2	0.1
Cardiovascular surgery	Exertional dyspnea	1	0.2	0.4
	Edema of the legs	1	0.2	
Urology	Burning urination and pain	2	0.5	0.9
Physiotherapy	Severe pain	2	0.5	1.2
	The loss of feeling in surgical area	1	0.2	

tients for TKA, 1 patient for THA) (0.9%), mechanical complication of prosthesis (3 patients for THA) (0.7%), periprosthetic fracture (1 patient for TKA) (0.2%) and septic arthritis (1 patient for TKA) (0.2%). A further 2% of the patients were prescribed

oral antibiotics and discharged 1.8% were diagnosed infections not related to the joint.

Logistic regression analysis showed that patients with a history of rheumatoid arthritis (RA), venous insufficiency (VI), chronic obstructive pul-

**TABLE 4:** The most common outcome of readmissions after discharge.

Results	Number (n=151)	%
Oral analgesics and NSAIDs	101	23.0
Revision of the prosthesis	9	2
Oral antibiotics	9	2
Non joint related infections	8	1.8
Physiotherapy	6	1.4
The peripheral nerve blocks	5	1.1
The wound infection and debridement	3	0.7
Thromboembolism	2	0.4

NSAIDs: Non-steroid anti-inflammatory drugs.

Non joint related infections: Urinary tract infections, upper airway infections and soft tissue infections.

**TABLE 5:** The risk factors for readmission-logistic regression.

Predictors	Odds ratio	95% confidence interval
Residence place	1.69	1.08-2.65
Comorbidities		
RA	2.55	1.29-5.05
VI	9.37	1.05-83.48
COPD	6.02	1.20-30.18
ASHD	1.89	1.02-3.52
Alzheimer's disease	7.33	1.50-35.76

RA: Rheumatoid arthritis; VI: Venous insufficiency; COPD: Chronic obstructive pulmonary disease; ASHD: Atherosclerotic heart disease.

monary disease (COPD), atherosclerotic heart disease (ASHD), Alzheimer's disease and patients living in the same city as the hospital where their surgery had taken place were found to have a higher risk of readmission within one year of discharge (Table 5).

## DISCUSSION

The results of this study showed that unplanned readmission after TJA was common. After discharge from the hospital, most of the patients attended the orthopedic outpatient clinic. The most common reason for readmission was pain related to the surgical procedure. Most of the patients who were readmitted to the hospital were prescribed oral analgesic and NSAIDs. Patients with some comorbidities were found to have a higher risk of readmission within one year of discharge.

The mean age of the patients was 67.7±8.4 years, 86.1% of the patients were female, 94.5% of the patients had undergone TKA and 82.7% of the patients had comorbidities. Osteoarthritis and obesity negatively affect the knee joints more than the hips. These are the major factors for the increasing demand for TKA both in the world and in our country.<sup>18</sup> Half of the patients were hospitalized for more than 5 post-operative days, 63% of the patients lived in the same city as the hospital where they had surgery. Readmission rates of the patients was 34.3%. Similarly, a previous study showed that patients' age ranged from 50 to 80 years, patients had comorbidities, especially congestive heart failure, coronary artery disease and diabetes mellitus, and patients were mostly hospitalized for more than 5 postoperative days.<sup>3</sup> Another study reported that 62.4% and 55.7% of the patients were female for TKA and THA, respectively.<sup>15</sup> Zmis-towski et al.'s study found that the majority of patients lived 20-50 km distance from the hospital.<sup>2</sup>

A few previous studies relating to readmission after TJA specifically focus on the rate, reason, and risk factor for readmission.<sup>1,2,15,16,19</sup> In this study, we examined outpatient clinics attendance of patients after discharge. After discharge from the hospital, 69.1% of the patients attended the orthopedic outpatient clinic once and 8% patients twice. Additionally, second most commonly admitted outpatient clinic was emergency department. It is thought that the patients firstly applied to the outpatient clinic of the department where they had surgery, secondly applied to the emergency department for postoperative problems. In the light of these data, it is thought that patients need a more systematic discharge education process in Turkey.

The most common reasons for readmissions after discharge were grouped as each outpatient clinic. There were a variety of reasons for readmission. The most common readmission reason was pain in those patients who attended orthopedic and emergency outpatient clinics. Other reasons for readmission were the limitation of movements and swelling at the surgical site, respiratory problems and cough, sputum and fever resulting in infectious complications, pulmonary and venous embolism and mechanical problems related to the prosthesis in the

current study. Ramkumar et al. also found that the most common reasons for readmission were pain and poor mobilization related to the surgery.<sup>1</sup> Saucedo et al. showed that the top medical reasons for readmission included mostly cardiac and pulmonary problems (dysrhythmias, pulmonary embolism, and pneumonia).<sup>3</sup> Similarly, Avram et al. reported that the most common reasons for readmission were found to be septic complication related to the joint and cardiovascular event.<sup>16</sup> The current results might be due to poor pain management in the postoperative period, patient education and counseling, and home care facility in the hospital where the research was conducted. For this reason, it would be appropriate to investigate this situation with new studies.

Some studies related to readmission after TJA specifically focus on the most common readmission diagnoses.<sup>1,3</sup> In the present study, we also examined what was recommended to the patients who readmitted to the hospital. The most common outcomes of readmissions after discharge were prescribed oral analgesic and NSAIDs to relieve pain in the surgical area. Two percent of the patients needed revision of the prosthesis due to different reasons and 2% of the patients were prescribed oral antibiotics, while 1.8% of the patients were diagnosed with non-joint related infections. Saucedo et al. also showed that most common result of readmission was other postoperative infections and Kurtz et al. found that most common result of readmission was dislocation of the prosthesis (5.9%) for THA.<sup>3,4</sup> Although complications of surgery are inevitable, well-planned postoperative care, discharge education, pain management and home care can result in better outcomes. Coordination and communication among members of the orthopedic team is essential to ensure optimal outcome in the patients with TJA.

According to the logistic regression analysis for the risk factors for readmission after TJA, patients with a history of RA, VI, COPD, ASHD, Alzheimer's disease and patients living in the same city as the hospital where the surgery took place were found to have a higher risk of readmission within one year of discharge. Similarly, Avram et al. identified patient's age, number of comorbidities, and length of hospital

stay as significant predictors of readmission ( $p < 0.1$ ). Urish et al. showed that number of comorbidities, increased length of hospital stay, were associated with a higher likelihood of readmission ( $p < 0.05$ ) and Zmistowski et al. indicated that male sex, increased length of hospital stays, decreased distance to the hospital were significant independent predictors of unplanned readmission ( $p < 0.1$ ).<sup>2,13,16</sup> Patients with a history of RA, VI, COPD, ASHD, Alzheimer's disease and patients living in the same city as the hospital where the surgery took place should be considered in preoperative patient evaluation in terms of readmission.

#### LIMITATIONS OF THE STUDY

This study has some limitations. First, there is not a central electronic system in which all patient records are kept. Each hospital in Turkey has its own database system. This study consists of data from only one center. Second, the patients can apply to all public and university hospitals free of charge thanks to their general health insurance. For this reason, patients can have applied to different hospitals, not to the hospital where they had surgery because of postoperative problems. Third, the patients were only examined to readmission within one year of surgery. Therefore, long term readmission rates were not known.

#### CONCLUSION

In summary, rates, reasons, and risk factors of readmission after TJA are an increasingly important issue in arthroplasty surgery. Our study found unplanned readmission rates of 34.3% within one year of TJA. The most common reasons for readmission were pain related to the surgical procedure, the limitation of movements and swelling in the surgical site. A small proportion of the patients needed revision of prosthesis. Furthermore, our study not only identified readmission rate of TJA but also risk factors or predictors of readmission. Future studies should consider residence place as a predictor of readmission. Also, improved patient selection for discharge to optimal management of patients with comorbidities such as rheumatoid arthritis, atherosclerotic heart disease should benefit the efficiency of care after primary

arthroplasty. These results suggest that the reasons of readmission are not easily preventable. It is thought that the patients undergoing TJA can need a holistic approach to care, discharge education, home monitoring, and follow-up to reduce and prevent unplanned readmission. Furthermore, well-organized preoperative preparation and postoperative education are required for patients with comorbidity. Especially, policymakers and hospital administrators should consider scientific data to predict the risk of unplanned readmission.

### Acknowledgments

The authors would like to thank the participants of this study, Bulent Erdemli MD, who is the Orthopedic Clinic Chief Doctor and Zahide Baysarı RN, who is the Orthopedic Clinic Chief Nurse.

### Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that pro-

vides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

### Conflict of Interest

No conflicts of interest between the authors and/or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

### Authorship Contributions

**Idea/Concept:** Çiğdem Canbolat Seyman; **Design:** Çiğdem Canbolat Seyman; **Control/Supervision:** Çiğdem Canbolat Seyman, Hayriye Ünlü; **Data Collection and/or Processing:** Çiğdem Canbolat Seyman; **Analysis and/or Interpretation:** Çiğdem Canbolat Seyman, Hayriye Ünlü; **Literature Review:** Çiğdem Canbolat Seyman, Hayriye Ünlü; **Writing the Article:** Çiğdem Canbolat Seyman, Hayriye Ünlü; **Critical Review:** Çiğdem Canbolat Seyman, Hayriye Ünlü; **References and Fundings:** Çiğdem Canbolat Seyman, Hayriye Ünlü; **Materials:** Çiğdem Canbolat Seyman, Hayriye Ünlü.

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