



# In-hospital complications following total knee and hip arthroplasty in patients with human immunodeficiency virus

Mustafa Akkaya, MD, PhD<sup>1,2</sup>, Zoltan Buday, MD<sup>3</sup>, Serhat Akcaalan, MD<sup>1,2</sup>, Philip Linke, MD<sup>1</sup>,  
Thorsten Gehrke, MD<sup>1</sup>, Mustafa Citak, MD, PhD<sup>1</sup>

<sup>1</sup>Orthopaedic Surgery, Helios ENDO-Klinik, Hamburg, Germany

<sup>2</sup>Department of Orthopedics and Traumatology, Ankara Yıldırım Beyazıt University, Ankara, Turkey

<sup>3</sup>Orthopaedic Surgery, Uzsoki Hospital, Budapest, Hungary

Total joint arthroplasty (TJA) is a treatment option that has been increasingly preferred in conditions which lead to joint damage such as severe osteoarthritis (OA), rheumatoid arthritis or avascular necrosis (AVN).<sup>[1-3]</sup> Patients with conditions that particularly affect the hip and knee joint experience a considerably impaired quality of life (QoL),<sup>[4-6]</sup> in which two main TJAs, i.e., total hip arthroplasty (THA) and total knee arthroplasty (TKA) are frequently preferred in the treatment of such patients. The number of primary and revision THAs and TKAs performed has been rising each day due to the expanding population and prolonged life span.<sup>[3,7,8]</sup>

In the past, surgeons were not eager to perform such QoL procedures in patients with immune deficiency diseases due to the surgical risks involved

Received: January 09, 2022

Accepted: February 02, 2022

Published online: March 28, 2022

**Correspondence:** Mustafa Citak, MD. Department of Orthopaedic Surgery, HELIOS ENDO-Klinik Hamburg, 22767 Hamburg, Germany.

E-mail: mcitak@gmx.de

Doi: 10.52312/jdrs.2022.550

**Citation:** Akkaya M, Buday Z, Akcaalan S, Linke P, Gehrke T, Citak M. In-hospital complications following total knee and hip arthroplasty in patients with human immunodeficiency virus. Jt Dis Relat Surg 2022;33(1):3-8.

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## ABSTRACT

**Objectives:** This study aims to analyze the in-hospital complication rates in patients with human immunodeficiency virus (HIV) following primary total knee (TKA) and total hip arthroplasty (THA).

**Patients and methods:** This retrospective study included a total of 37 patients including 11 patients undergoing TKA (11 males; mean age: 60.8±16.0 years; range, 48 to 80 years) and 26 patients undergoing THA (23 males, 3 females; mean age: 49.9±11.5 years; range, 35 to 70 years) between January 2010 and December 2019. The patients were evaluated in terms of body mass index (BMI), American Society of Anesthesiology (ASA) scores, pre- and postoperative blood tests, indications for surgery, operative time, length of hospital stay, and in-hospital complications.

**Results:** The overall in-hospital complication rate following primary TKA (n=2, 18.2%) and THA (n=2, 7.7%) was 10.8%. Following TKA, one patient had deep vein thrombosis and one patient developed acute renal failure. In the THA group, postoperative delirium and trochanteric fracture were noted.

**Conclusion:** The in-hospital complication rates increased in HIV-positive patients following TKA and THA. The risk of complications can be mitigated with the aid of a better interdisciplinary cooperation and thorough surgical planning.

**Keywords:** Arthroplasty, hip, human immunodeficiency virus, knee.

in TJA, i.e., infection-related complications.<sup>[9-11]</sup> On the other hand, the number of patients fighting against immune deficiency diseases has dramatically increased in recent years.<sup>[12-14]</sup> According to the latest report of the Joint United Nations Programme on HIV/AIDS (UNAIDS) issued in 2020, human immunodeficiency virus (HIV) that leads to immune deficiency by attacking CD4 T-lymphocytes affects 31.6 to 44.5 million individuals globally, whereas the estimated number of new infections reported each year ranges between 1.2 and 2.2 million.<sup>[15]</sup>

On the other hand, medical management of HIV has significantly contributed to the life span of patients infected with HIV, thanks to the development of highly active antiretroviral therapy (HAART) since 1997.<sup>[16,17]</sup> Currently, patients usually reach their fifties and sixties, and exhibit age-related degenerative conditions.<sup>[18]</sup> Therefore, treating degenerative joint diseases in this patient group is of utmost importance to improve QoL.<sup>[19,20]</sup> However, there are varying complication rates in the literature depending on the existing infection load, HAART status, and comorbidities in patients undergoing TJA.<sup>[21-24]</sup> Therefore, TJA practices still involve several uncertainties in this patient population.

In the present study, we aimed to evaluate the in-hospital complication rates in patients with HIV following primary TKA and THA at a high-volume arthroplasty center.

## PATIENTS AND METHODS

This single-center, retrospective study was carried out at ENDO-Klinik Hamburg, Department of Orthopaedic Surgery between January 2010 and December 2019. A total of 37 patients who were positive for HIV and who underwent primary, unilateral TKA (11 males; mean age: 60.8±16.0 years;

range, 48 to 80 years) or THA (23 males, 3 females; mean age: 49.9±11.5 years; range, 35 to 70 years) were included. Patients who underwent septic revision and those with an active HIV infection were excluded. A written informed consent was obtained from each patient. The study protocol was approved by the Ärztekammer Hamburg Ethics Committee (data/no; 2021/300086-WF). The study was conducted in accordance with the principles of the Declaration of Helsinki.

All surgeries were performed through high-volume arthroplasty surgeons. All patients received a single dose of antibiotic prophylaxis with cefazolin 2 g 30 to 60 min prior to surgery. The patients who underwent TKA were positioned in a supine position. The used approach was either the medial midvastus or parapatellar approach to the knee. All patients who underwent THA were positioned in a lateral decubitus position. A posterior approach to the hip was used in all cases.

The collected data consisted of comorbidities, type of the surgery, operated side, operative time, length of hospital stay, American Society of Anesthesiologists (ASA) scores, pre- and postoperative blood tests (hemoglobin [Hb], sodium [Na], potassium [K], leucocyte count, platelet count, and

**TABLE I**  
Demographic results of HIV-positive total joint arthroplasty patients

Variables	TKA					THA				
	n	%	Mean±SD	Median	Min-Max	n	%	Mean±SD	Median	Min-Max
Age (year)			60.8±16.0					49.9±11.5		
Sex										
Female	0	0				3	11.5			
Male	11	100				23	88.5			
Side										
Right	5					11				
Left	6					15				
Body mass index (kg/m <sup>2</sup> )										
Underweight (<18.5)	0	0				1	3.8			
Normal weight (18.5-24.9)	2	18.2				11	42.3			
Overweight (25-29.9)	8	72.7				12	46.2			
Obesity (≥30)	1	9.1				2	7.7			
ASA score										
I	0	0				1				
II	7	63.6				22				
III	4	36.4				3				
Operation time (min)				60	40-110				70	55-185
Length of hospital stay (days)				9	7-14				7.5	2-17

HIV: Human immunodeficiency virus; SD: Standard deviation; TKA: Total knee arthroplasty; THA: Total hip arthroplast.

	TKA	THA
	n	n
<b>Comorbidities</b>		
Arterial hypertension	5	8
Hepatitis B/C	3	4
Cerebral toxoplasmosis	2	2
Arrhythmia	2	2
Hemochromatosis	2	1
Type 2 diabetes mellitus	2	1
Hypothyroidism	2	1
Chronic renal failure	1	1
Nicotine abuse	1	3
Other	3	5
<b>In-hospital complications</b>		
Intraoperative	Acute renal failure	Trochanteric fracture
Postoperative	Deep vein thrombosis	Delirium

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

C-reactive protein [CRP]), demographics including age, sex and body mass index (BMI), as well as intra- and postoperative complications (in-hospital). Moreover, patients were also evaluated in terms of indications for surgery (primary/secondary OA) and revisions performed throughout follow-up.

### Statistical analysis

Statistical analysis was performed using the IBM SPSS version 26.0 software (IBM Corp., Armonk, NY, USA). Continuous variables were expressed in mean  $\pm$  standard deviation (SD) or median (min-max), while categorical variables were expressed in number and frequency. Normality of data was evaluated using the skewness and kurtosis values in Shapiro-Wilk test and histograms. The independent samples t-test and paired sample

t-test were used to compare pre- and postoperative changes of both procedures with a normal distribution. The Mann-Whitney U test was used to compare both procedures that did not exhibit a normal distribution. *P* values of  $<0.05$  and  $<0.01$  were considered statistically significant.

### RESULTS

Detailed information of patient characteristics, comorbidities, operative time, and length of hospital stay ( $p<0.05$ ) are summarized in Table I.

Of 11 patients who underwent TKA, nine (82%) had primary and two had secondary OA ( $n=1$  OA secondary to trauma and  $n=1$  OA secondary to AVN). Of 26 patients who underwent THA, eight (30.8%) had primary and 18 (69.2%) had secondary OA ( $n=13$  OA

Variables	Knee preoperative <sup>a</sup>	Knee postoperative <sup>b</sup>	Hip preoperative <sup>c</sup>	Hip postoperative <sup>d</sup>	a-b	c-d
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	<i>p</i>	<i>p</i>
CRP (mg/L)	2.2 $\pm$ 2.0	46.7 $\pm$ 52.2	3.2 $\pm$ 2.5	49.8 $\pm$ 38.9	0.018*	0.000**
Leukocyte (/nL)	6.2 $\pm$ 1.7	6.7 $\pm$ 2.3	6.6 $\pm$ 1.7	7.7 $\pm$ 5.1	0.404	0.302
Hb (gr/dL)	14.4 $\pm$ 1.2	11.6 $\pm$ 1.8	13.9 $\pm$ 1.5	11.0 $\pm$ 1.8	0.00**	0.00**
Na <sup>+</sup> (mmol/L)	140.8 $\pm$ 1.6	141.0 $\pm$ 3.4	140.7 $\pm$ 1.9	140.7 $\pm$ 2.7	0.862	0.949
K <sup>+</sup> (mmol/L)	4.1 $\pm$ 0.4	4.2 $\pm$ 0.27	4.0 $\pm$ 0.3	4.0 $\pm$ 0.5	0.531	0.522
Thrombocyte	199.6 $\pm$ 7	245.7 $\pm$ 49.3	260.7 $\pm$ 56.7	261.0 $\pm$ 88.2	0.023*	0.00**

SD: Standard deviation; CRP: C-reactive protein; Hb: Hemoglobin; Na: Sodium; K: Potassium; \*  $p<0.05$ ; \*\*  $p<0.01$ .

secondary to AVN, n=4 OA secondary to dysplasia, and n=1 OA secondary to trauma).

Comorbidities were investigated and 13 patients (n=5 TKA, n=8 THA) had arterial hypertension, seven patients (n=3 TKA, n=4 THA) had hepatitis B or C virus, and four patients (n=2 TKA, n=2 THA) had cerebral toxoplasmosis. A detailed list of comorbidities is provided in Table II.

The overall in-hospital complication rate following primary TKA (n=2, 18.2%) and THA (n=2, 7.7%) was 10.8% (Table II). Following TKA, one patient had deep vein thrombosis (DVT) and one patient developed acute renal failure. In the THA group, in one patient postoperative delirium was noted. The other patient had a trochanteric fracture, which is not related to the HIV (Table II). The patients were evaluated in terms of pre- and postoperative blood tests according to the type of surgery, whereas there was no statistically significant difference except for the changes in Hb, CRP, and platelet count (Table III).

## DISCUSSION

In the present study, we shared the experiences of a high-volume arthroplasty center with patients who were positive for HIV and underwent THA and TKA for degenerative joint disease. According to the literature, there are varying complication rates of arthroplasty procedures performed in patients who are positive for HIV.<sup>[10,22,23,25-27]</sup> Naziri et al.<sup>[10]</sup> reported the major and minor complication rates following THA in 9,275 HIV-positive patients and found that major complications occurred in 2.9% and minor complications in 5.2%. In another study conducted by Dimitriou et al.,<sup>[23]</sup> the risk of periprosthetic joint infection (PJI) was with 7.6% in HIV-positive patients who underwent THA and TKA, which was relatively high. In addition to CD4 levels and HAART status, comorbidities were also shown to have an effect on complication rates.<sup>[28-30]</sup> The present study revealed an in-hospital complication rate of 18.2% in patients who underwent TKA (2/11; acute renal failure and DVT) and 7.7% in patients who underwent THA (2/26; intraoperative trochanteric fracture and delirium). In this study, the in-hospital complication rate in patients who underwent TKA was higher than that reported in the literature. This can be attributed to the fact that the patients who underwent TKA (60.8±16.0 years) were in a more advanced age group compared to those who underwent THA (49.9±11.5 years) in the present study. However, it must be noted, that despite the large series, the number of included patients is still low.

Review of the literature reveals that the incidence of musculoskeletal problems has increased in patients who are positive for HIV due to the prolonged life span as a result of the advances in antiviral therapy.<sup>[30,31]</sup> The incidence of degenerative joint diseases increased particularly with age, while there was also an increase in the number of joint arthroplasties performed for AVN secondary to antiviral and steroid therapy.<sup>[32-34]</sup> In the present study, 50% of the patients who underwent THA had the operation due to AVN, which is consistent with the data provided in the literature.<sup>[35,36]</sup>

According to the literature, hepatitis is the most common comorbidity observed in patients with HIV and the risk of postoperative infection is significantly increased particularly in patients who have a chronic hepatitis C coinfection.<sup>[37,38]</sup> In this study, arterial hypertension was the most common comorbidity, followed by hepatitis and toxoplasmosis coinfections, respectively. In this case series consisting of 37 patients, there were no patients who developed PJI during follow-up at our hospital after primary joint arthroplasty. However, patients who were referred from an external center for septic revision were not included in the study. Therefore, it is possible to conclude that the rate of PJI reported in this study is lower than that among patients with coinfection, as reported in the literature.

Elevated CRP levels and decreased Hb and platelet count are expected in the early postoperative period after joint arthroplasty. The need for blood transfusion can be reduced by a detailed intraoperative bleeding control, topical-systemic tranexamic acid administration and the use of reinfusion systems, particularly in patients in whom transfusion is risky.<sup>[39,40]</sup> This eliminates the additional risk of transfusion and increased costs. In the present study, while there was a statistically significant difference between the pre- and postoperative Hb values, there was only one patient who needed a blood transfusion.

According to the literature, patients who are positive for HIV have a prolonged length of hospital stay following joint arthroplasty as compared to the normal population.<sup>[26,28]</sup> In this study, patients who underwent TKA and THA both had a prolonged length of stay at the hospital, while this length was more prolonged in patients who underwent TKA than in those who underwent THA, indicating a statistically significant difference (9/7.5,  $p < 0.05$ ). The prolonged length of hospital stay can be attributed to postoperative rehabilitation, as well as the fact that the patients who underwent TKA were in a more

advanced age group than those who underwent THA.

Nonetheless, this study has several limitations. First, it was not possible to make a detailed evaluation of the viral load status, since preoperative CD4 T-lymphocyte counts were not available. Second, there was not enough information on the history of antiviral therapy of the patients included in this study. Third, we could not evaluate the clinical status of the patients, since follow-up examination were not available. Fourth, a control group of patients without HIV positive, were not observed. Thus, a direct comparison of in-hospital complications was not feasible. However, the study results were compared to the results reported in the current literature.

In conclusion, this study, which is among the largest case series conducted at a single center, showed that the in-hospital complication rates increased in HIV-positive patients following TKA and THA. This vulnerable patient population, which is expected to expand over time, would continue to need joint arthroplasty procedures. Therefore, minimizing the complication risks by means of enhancing interdisciplinary cooperation and detailed surgical planning should be a priority.

#### Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

#### Funding

The authors received no financial support for the research and/or authorship of this article.

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