



Total knee arthroplasty in patients with rheumatoid arthritis – midterm results

Totalna artroplastika kolena kod bolesnika sa reumatoidnim artritismom – srednjoročni rezultati

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Abstract

Background/Aim. Total knee arthroplasty in patients with rheumatoid arthritis is an effective method of eliminating pain and improving functional status, but it is associated with a number of unique challenges. The aim of this study was to evaluate the clinical and radiographic outcomes of total knee arthroplasty, as well as patient satisfaction, in this series of patients with rheumatoid arthritis. **Methods.** Between January 2001 and 2012, 108 total knee arthroplasties in 78 patients with rheumatoid arthritis were performed, utilizing a posterior-stabilized prostheses. The average age of the patients was 58 ± 12.4 years, and 88% were females. Median follow-up of patients was 80 months with interquartile range of 34 months (min-max: 36-132 months). **Results.** Average Knee Society score improved from preoperative 18 ± 11.4 to postoperative 83 ± 3.5 , and Functional Knee Society score from 21 ± 9.9 to 50 ± 5.9 . Western Ontario and McMaster Universities Arthritis (WOMAC) knee injury and osteopaedic outcome scores improved from 23 ± 6.4 to 69 ± 4.6 postoperatively. In 25 (23.14%) knees radiolucent lines of less than 2 mm were found and they were not progressive. Survival rate excluding deep infection was 99.1%. **Conclusion.** Total knee arthroplasty is an effective procedure of treatment of damaged knee joint in patients with rheumatoid arthritis.

Key words: arthritis, rheumatoid; knee; arthroplasty; patient satisfaction; treatment outcome.

Apstrakt

Uvod/Cilj. Totalna artroplastika kolena kod bolesnika sa reumatoidnim artritismom je uspešna metoda u otklanjanju bola i poboljšanja funkcionalnog statusa, ali je povezana sa nekoliko jedinstvenih izazova. Cilj ove studije bio je procena kliničkih i radiografskih rezultata totalne artroplastike kolena, kao i zadovoljstvo bolesnika, kod ove serije ispitanika sa reumatoidnim artritismom. **Metode.** U periodu od januara 2001 g. do 2012 g. urađeno je 108 totalnih artroplastika kolena kod 78 bolesnika sa reumatoidnim artritismom, korišćenjem endoproteze sa zadnjom stabilizacijom. Prosečna starost bolesnika iznosila je $58 \pm 12,4$ godine, a 88% su bile osobe ženskog pola. Medijana vremena praćenja bolesnika bila je 80 meseci sa interkvartilnim opsegom od 34 meseca (min-max: 36–132 meseca). **Rezultati.** Prosečan *Knee Society score* (KSS) je bio poboljšán sa preoperativnih $18 \pm 11,4$ na postoperativnih $83 \pm 3,5$, a *Functional Knee Society score* (FKSS) sa $21 \pm 9,9$ na $50 \pm 5,9$. *Western Ontario and McMaster Universities Arthritis* (WOMAC) skor bio je poboljšán sa $23 \pm 6,4$ na $69 \pm 4,6$ postoperativno. Kod 25 (23,14%) kolena konstatovane su radiolucentne linije manje od 2 mm koje nisu bile progresivne. Stepén preživljavanja isključujući duboku infekciju je bio 99,1% u prosečnom vremenskom praćenju od 80 meseci. **Zaključak.** Totalna artroplastika je efikasna procedura lečenja oštećenog zglobova kolena kod bolesnika sa reumatoidnim artritismom.

Ključne reči: artritis, reumatoidni; koleno; artroplastika; bolesnik, zadovoljstvo; lečenje, ishod.

Introduction

The knee joint is one of the most commonly affected joints in rheumatoid arthritis (RA) and one or both knees are affected in 90% of the cases of long-term rheumatoid arthritis. Despite of highly effective biological therapies, in

approximately 20% to 25% of patients with rheumatoid arthritis, an advanced form of arthritis with joint destruction develops and the knee joint is the one most commonly affected¹. Patients with rheumatoid arthritis have poor quality of bones and soft tissue due to the inflammatory disease itself, inactivity and application of corticosteroid therapy. In these

patients, there are problems with regard to wound healing and the development of systemic infections due to existing immunosuppression². In order to improve total knee arthroplasty (TKA) in these patients, significant considerations in terms of preoperative evaluation and surgical techniques are required³. The aim of this study is to evaluate the clinical and radiographic outcomes of total knee arthroplasty, as well as satisfaction in this series of patients with rheumatoid arthritis.

Methods

In the period from January 2002 to January 2012, at the III Female Department of the Institute for Orthopedic Surgery "Banjica" in Belgrade, Serbia, 108 posterior stabilized total knee arthroplasties were performed in 78 patients with rheumatoid arthritis. The average age of the patients was 58 ± 12.4 years, with an average body mass index of $26.0 \pm 4.4 \text{ kg/m}^2$ and 88.0% were females. All patients had been previously treated for RA for at least 5 years. All total arthroplasties were performed with a standard medial parapatellar arthrotomy and resection of the posterior cruciate ligament, as well as complete synovectomy. Distal femoral cut was made with intramedullary guide and proximal tibial cut with extramedullary alignment guide. Knee balance was done by combined techniques. In varus and valgus deformities gradual medial and lateral release was done. Patella was replaced in all cases. Median follow-up time was 80 months with interquartile range of 34 months (min-max: 36-132 months). Patient evaluation was done preoperatively and postoperatively in a time period of 3, 6 and 12 months, and annually thereafter. Patients were clinically assessed preoperatively and postoperatively applying the clinical grading system of the Knee Society (Knee Society Clinical Rating System) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)^{4,5}. In order to evaluate the pain located in the knee after TKA, we used a visual analogue scale (VAS). The degree of patient satisfaction after total knee arthroplasty was measured by the visual analogue scale of satisfaction. Radiographic evaluation of the knee was performed preoperatively and postoperatively after 3, 6

and 12 months and then annually. Radiological assessment was carried out according to the radiographic evaluation system of the Knee Society (Knee Society Roentgenographic Evaluation System) by making an anteroposterior and lateral knee X-ray in standing position and tangential X-ray of the patella (Merchant's view). Composite event, which was considered as the outcome of this study, included deep infection of wound and revision surgery.

Following a test of statistical normality, continuous variables are presented as mean \pm standard deviation (SD) or median (interquartile range). Categorical variables are reported as counts with percentages. Continuous variables were compared using Student's *t*-test for paired groups. Differences in categorical variables were tested by χ^2 -test or Fisher's test, as appropriate. Kaplan-Meier survival curves were used to show overall surviving during follow-up period and the difference between groups according to value of VAS of pain and VAS of satisfaction. Statistical significance was estimated by the Log-rank test. The receiver operating characteristic (ROC) analysis was used for assessing the accuracy of diagnostic tests. Correlation between the scores was assessed by Pearson's correlation test.

A $p < 0.05$ was considered statistically significant. Statistical analysis was performed using the SPSS, version 18.0 (SPSS Inc) software package.

Results

Average preoperative Knee Society Score (KSS) increased from 18 ± 11.4 to 83 ± 3.5 postoperatively ($p < 0.05$); preoperative functional KSS from 21 ± 9.9 to 50 ± 5.9 ($p < 0.05$); and WOMAC score from preoperatively 23 ± 6.4 to postoperatively 69 ± 4.6 ($p < 0.05$) (Figure 1).

The average VAS score of pain < 20 was present in 77 (71.3%) of the patients. Average VAS score of satisfaction > 80 was present in 90 (83.3%) of TKAs.

Scaled outcomes of clinical scores are shown in Table 1. An excellent score is 80 to 100 points; very good, 60 to 79 points; good, 40 to 59 points; satisfactory, 20 to 39 points; and unsatisfactory less than 20 points.

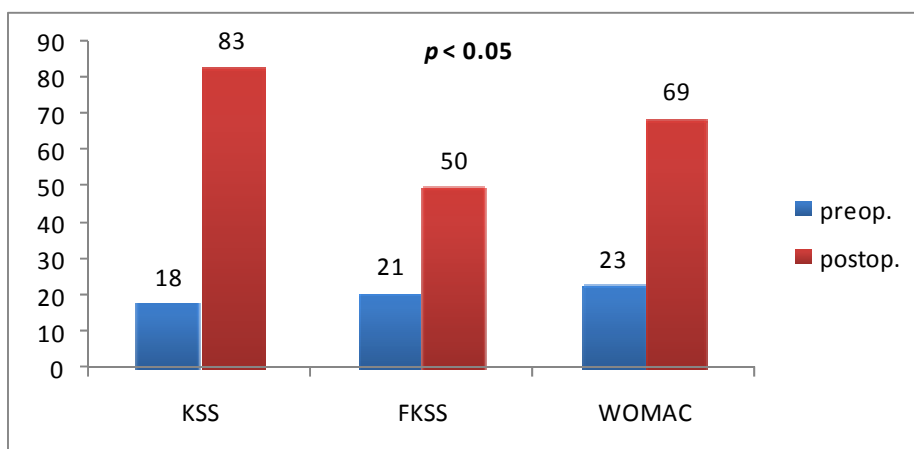


Fig. 1 – Comparison of clinical scores pre- and postoperatively.

KSS – Knee Society Score; FKSS – Functional Knee Society Score; WOMAC – Western Ontario and McMaster University Osteoarthritis Index.

Table 1

The results of clinical scores in knees with rheumatoid arthritis (RA)					
Scores	Excellent	Very good	Good	Satisfactory	Unsatisfactory
Preop FKSS, n (%)	0 (0)	0 (0)	0 (0)	56 (51.9)	52 (48.1)
Preop FKSS, n (%)	0 (0)	0 (0)	0 (0)	53 (49.1)	55 (50.9)
Preop WOMAC, n (%)	0 (0)	0 (0)	0 (0)	72 (66.7)	36 (33.3)
Postop KSS, n (%)	90(88.3)	18 (11,7)	0 (0)	0 (0)	0 (0)
Postop FKSS, n (%)	0 (0)	4 (3.7)	96 (88,9)	8 (7.4)	0 (0)
Postop WOMAC, n (%)	4 (3.7)	103 (95.4)	1 (0.9)	0 (0)	0 (0)

KSS – Knee Society Score; FKSS – Functional Knee Society Score; WOMAC – Western Ontario and McMaster University Osteoarthritis Index.

In early postoperative radiographs and subsequent and final examinations on anteroposterior (AP) and lateral radiographs in standing position signs of loosening of endoprosthetic system were found in 3 patients and they underwent revisional surgery. Radiolucent lines of less than 2 mm were found in 25 (23.14%) knees which were not progressive. Average postoperative femoro-tibial angle was 6.2° (range 3.5 to 12.0°). In radiographic analysis of component position the average α (alpha angle) was 95° (range 84° to 101°), average tibial angle β was 89.1° (range 81° to 94°). The flexion of the femoral component, γ angle was 2.7° on average (range 0° to 14°), and the slope of the tibial component, angle δ was 88.4° on average (range 82° to 95°) (Figure 2).

In two (1.9%) patients intraoperative fracture of proximal tibia occurred, which was treated by closed reduction and osteosynthesis. Loosening occurred in one patient 72 months after the periprosthetic fracture and revision surgery was performed, while another patient's implant remained stable at follow-up. In two more cases there was loosening of the endoprosthetic system, one after 108 months and the other after 36 months, and revision surgery was done in both cases. One (0.9%) patient developed an infection 36 months after primary surgery. The treatment was carried out in two stages. In 2 (1.9%) patients aseptic loosening occurred, after which the treatment was carried out by applying the revision implant. In 2 (1.9%) patients there was a patellar luxation which was treated non-operatively. In one patient

peroneal nerve palsy appeared, that only partially withdrew after the treatment. One patient developed deep vein thrombosis in the lower leg but it was cured without any consequences; in another case pulmonary embolism developed, but the patient recovered after the adequate treatment. Survival rate, excluding deep infection, in an average period of 80 months, was 99.1%. Regarding the survival rate with revision surgery as the final outcome, after 5 years it was 98.2%, and after 10 years the percentage decreased to 96.4%. In 4 (12.9%) patients who had VAS score of pain > 20 revision knee arthroplasty was executed during the monitoring period, while in patients with VAS of pain ≤ 20 there was no revision, which was a significant difference ($p = 0.001$) (Figure 3). VAS score of pain itself showed high discriminatory ability [area under curve (AUC) 0.931, $p = 0.003$] for prediction of revision surgery (Figure 4).

Out of 18 patients with VAS score satisfaction < 80 , 3 (16.7%) of them had revision, i.e. out of 90 cases with VAS satisfaction ≥ 80 , only 1 (1.1%) had revision which was a significant difference ($p = 0.001$) (Figure 5). VAS score of satisfaction itself showed high discriminatory ability (AUC 0.933, $p = 0.003$) for prediction of revision surgery (Figure 6).

Limiting values of VAS score of pain > 20 and VAS of satisfaction < 80 showed a high degree of sensitivity and specificity for predicting revision surgery (Table 2) in patients with RA. Sensitivity and specificity of VAS score of pain > 20 was 100% or 74.0%, respectively, and for VAS score

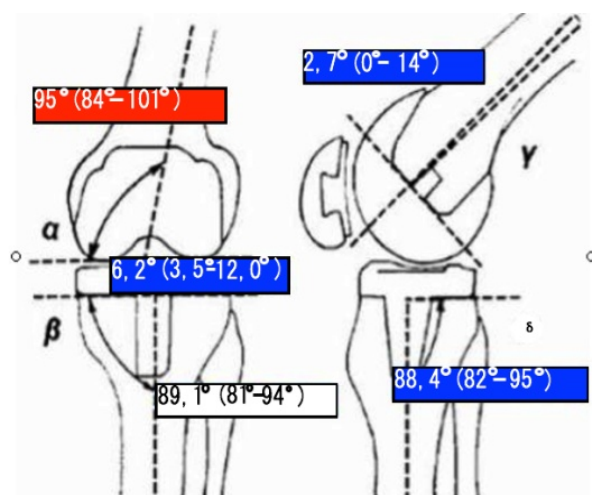


Fig. 2 – Radiographic analysis - the average angles components positions.

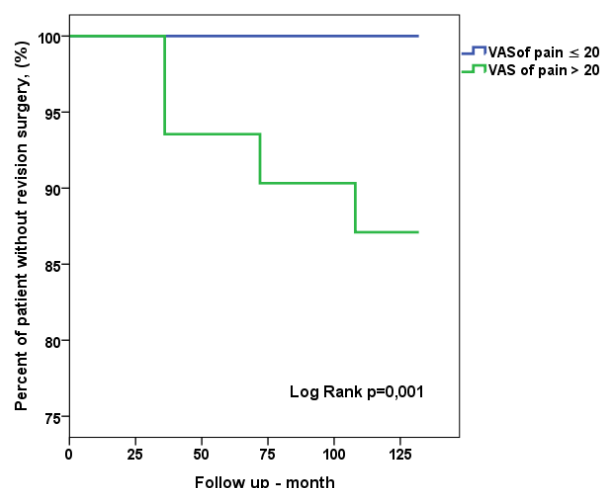


Fig. 3 – Kaplan Meier survival curve of patients with rheumatoid arthritis (RA) without revision during the follow-up depending on the perception of pain. VAS – Visual analogue scale.

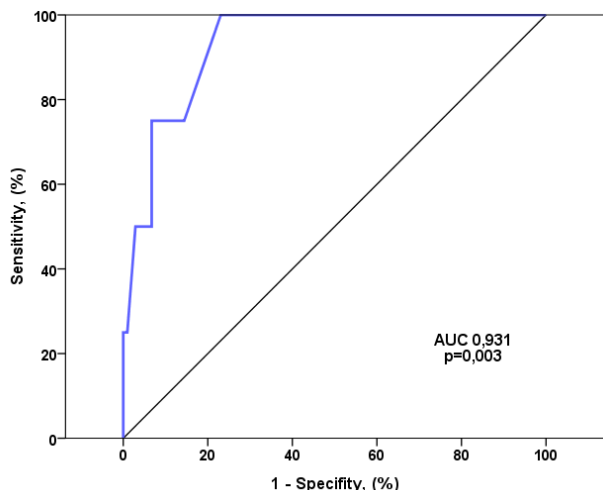


Fig. 4 – Receiver operating characteristic (ROC) curve of visual analogue scale (VAS) of pain for the revision surgery event occurrence.
AUC – area under curve.

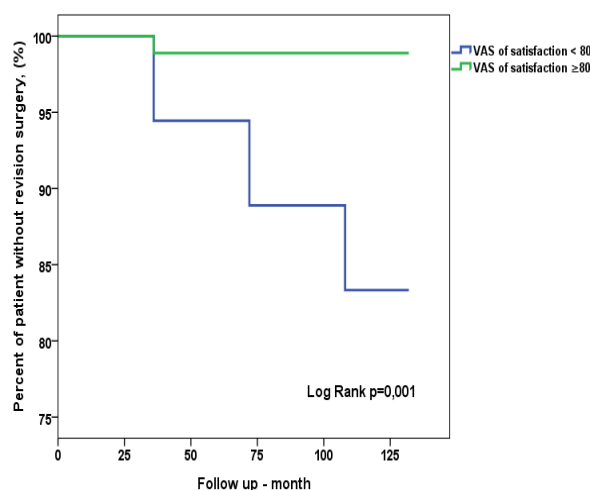


Fig. 5 – Kaplan Meier survival curve of patients with rheumatoid arthritis without revision during the follow-up depending on the perception of satisfaction.

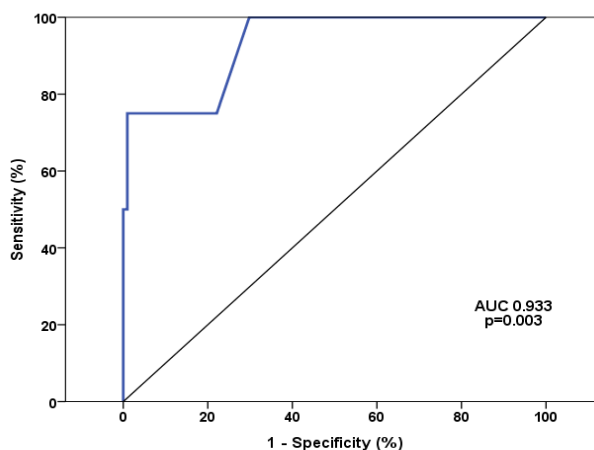


Fig. 6 – Receiver operating characteristic (ROC) curve of visual analogue scale (VAS) of satisfaction for the revision surgery event occurrence.
AUC – area under curve.

Table 2
Comparison of the representation of after surgery revision, depending on the “critical values” of visual analogue scale (VAS) of pain and VAS of satisfaction in a population of patients with rheumatoid arthritis

VAS score	With revision, n = 104	Without revision, n = 4	p
of pain > 20, n (%)	27 (26.0)	4 (100)	0,006
of satisfaction < 80, n (%)	15 (14.4)	3 (75.0)	0,014

of satisfaction sensitivity was 75.0% and specificity 85.6%.

Clinical score analysis showed that there was a significant correlation between VAS of satisfaction and VAS of pain with postoperative KSS, and somewhat lower correlation between VAS of satisfaction with postoperative FKSS and WOMAC score. Other correlations were not distinct (Table 3).

Discussion

Total knee arthroplasty in patients with rheumatoid arthritis is a reliable procedure that reduces pain, increases range of motion and functional status of patients. Regarding the clinical outcomes of total knee arthroplasty in patients with

RA and osteoarthritis (OA) there are well-documented studies, with a significantly smaller number of studies regarding the outcomes in patients with RA⁶⁻⁸. In our study, all patients had excellent outcomes in terms of reduction of pain and stability, but the functional scores were slightly lower. There are several reasons for that, but probably the main reason is that patients also had significantly lower preoperative scores, which is linked to socioeconomic factors, due to which patients came with established deformities and extremely poor function. In addition, these patients had other joints affected as well and therefore worse functional outcomes. Evaluating the outcome of total knee arthroplasty, it cannot be said that the KSS is a sensitive parameter because almost in majority

Table 3

Variables	Correlation of clinical scores			
	VAS score of pain		VAS score of satisfaction	
	r	p	r	p
Preop KSS	= 0.063	= 0.489	= 0.099	= 0.306
Preop FKSS	= 0.033	= 0.736	= 0.045	= 0.644
Preop WOMAC	= 0.026	= 0.789	= 0.037	= 0.707
Postop KSS	= 0.411	< 0.001	= 0.579	< 0.001
Postop FKSS	= 0.293	= 0.002	= 0.346	< 0.001
Postop WOMAC	= 0.321	= 0.002	= 0.349	< 0.001

VAS – visual analogue scale; KSS – Knee Society Scale; FKSS – Functional Knee Society Score; WOMAC – Western Ontario and MC Master Universities Osteoarthritis Index.

of the presented studies it was higher than 80. Also, the radiographic findings themselves are not specific in terms of predicting the outcomes of TKA, because of the lack of correlation between the occurrence of thin radiolucent lines and clinical outcomes. Therefore, the introduction of additional scores for assessing the outcomes, WOMAC score, would probably result in a more comprehensive picture of the outcome of TKA. In the opinion of the orthopedic community, however, although using more than one scoring system produces a reliable result in terms of the efficiency of the procedure, all of them are mainly the result of patients' response to the level of pain, function, return to specific activities and the medical objective measurement of motion range and stability. However, in addition to the above, the outcomes of total knee arthroplasty may also be affected by patients' expectations⁹.

Patients' satisfaction is an important parameter of successfully performed total arthroplasty¹⁰. There is a well-known discrepancy between rating the success of TKA by the operator and by the patient, i.e. there are certain discrepancies with regard to improving the quality of life of patients with total knee arthroplasty. Numerous studies show that the degree of patients' satisfaction after total arthroplasty is only 82% to 89%^{11,12}.

In our study, the degree of satisfaction of patients with RA was exceptional, only 16.7% had < 80. One major reason was probably patients' expectations regarding TKA, in addition to other factors such as low preoperative scores and complications. In order to find an adequate explanation for this degree of satisfaction with total knee arthroplasty, we tried to determine the connection between VAS score of satisfaction and scores applied. We found a significant correlation between VAS score of satisfaction and postoperative KSS, FKSS and less strong correlation with postoperative WOMAC score. In addition, we found a significant correlation between VAS score of pain and VAS score of satisfaction and marked VAS score of pain and VAS score of satisfaction as significant predictors of revision surgery. Based on this, we can say that the elimination of pain, along with well performed total knee arthroplasty, correlates well with quality of life and patients' satisfaction, with the additional observation that VAS score of pain and satisfaction, as independent predictors of TKA revision surgery, represent an important parameter for predicting success of total knee arthroplasty.

Survival rate of total arthroplasty ranges from 81% to 98.2% depending on the presented studies and depending on the set parameters concerning the index event, where revisi-

on was most often cited as the final event¹³. In our study the survival rate depending on the selected scenario was: excluding deep infection, survival rate in patients with RA in an average period of 80 months was 99.1% and in patients with RA within the same monitoring time 97.5% (best scenario). The survival rate with revision surgery as the final outcome in patients with RA was 98.2% after 5 years, and after 10 years the percentage decreased to 96.4%, while in patients with primary osteoarthritis, survival rate showed a smaller rate of decline, from 95% to 94%. During the average follow-up time of 80 months, survival rate of TKA in patients with RA was 97.1%, and in patients with OA 95%.

By introducing another parameter associated with TKA into consideration, VAS score of pain, the survival rate in total population of patients with VAS of pain ≤ 20 was 100%, while in patients with VAS score of pain > 20 during the average period of 80 months it was 84%, which clearly indicates a high discriminatory ability of VAS score of pain to predict revision surgery. In the same specified conditions, survival rate in patients with RA in cases where VAS score of pain was ≤ 20 was 100%, and when it was > 20, survival rate was 90% during the average monitoring period. The survival rate of patients with OA and VAS score of pain ≤ 20 was 100%, while with VAS score of pain > 20 it was 78%. In both groups VAS score of pain showed high discriminatory ability for revision surgery of TKA.

Analyzing the survival rate with revision surgery as the final outcome and adding the parameter of patients' satisfaction with their TKA, within the average follow-up period, the survival rate of patients in the total population of patients with VAS of satisfaction ≥ 80 was 99%, and when VAS of satisfaction was < 80, the survival rate was 90%. In the same conditions, the survival rate in patients with RA was: VAS of satisfaction ≥ 80 – survival rate of 98%, and VAS of satisfaction < 80 – survival rate 88%. In patients with PA in the same specified conditions, with VAS of satisfaction ≥ 80, the survival rate was 100%, and with VAS of satisfaction < 80, the survival rate was 91%.

Survival rate of total arthroplasty in our study is consistent with other studies known to us.

In terms of complication rate of total knee arthroplasty in patients with RA, there are several studies that indicate the existence of a higher complication rate compared to TKA in primary knee arthrosis^{14,15}, as well as others which do not mention a greater complication rate^{6,16}. There are many rea-

sons why patients with RA, compared to those with OA, may be at greater risk of early complications after total knee arthroplasty. Firstly, it is the effect of drugs that modify the disease, systemic corticosteroid application, use of biological drugs, all of which act through immuno modulation and are associated with delayed wound healing and increased risk of postoperative infection^{17, 18}; furthermore, systemic nature of RA contributes to the occurrence of multiple comorbidities¹⁹. A particular problem is synovitis itself, so that patients with RA compared to those with primary osteoarthritis have more tender soft tissues, weakened tendons, ligaments and enthuses²⁰. Patients with RA often have osteopenia or osteoporosis and altered periarticular bone anatomy²¹. These anatomical changes represent an additional problem during the treatment of soft tissue, establishment of joint shaft and balance, component fixation and establishment of good articular mechanics after TKA. In our study, the infection rate was 0.9% and a deep infection was formed in only one patient. This rate of post-operative infection is consistent with some studies, while being significantly lower than in others. The probable reason for this could be a comprehensive and thorough preoperative preparation, the involvement of other specialists, balanced use of drugs in order to avoid infection and worsening of RA, strict application of the basic principles of total arthroplasty, prophylactic use of antibiotics, and an experienced surgical team which, in addition to a well-

performed total arthroplasty, reduced the time of the surgery to the minimum. The rate of other complications in this study was consistent with the studies known to us.

Conclusion

Total knee arthroplasty is one of the most successful surgical procedures performed with the aim of reducing pain and improving functional status of patients with rheumatoid arthritis. It is necessary to fully understand the systemic nature of rheumatoid arthritis for a successful total knee arthroplasty, because these patients often have accompanying diseases, anesthesiological and multiple musculoskeletal problems with considerable potential for complications. Despite all the complex conditions that are often encountered in patients with rheumatoid arthritis, a timely, well performed total knee arthroplasty becomes an effective procedure with a moderate degree of complication and can lead to improvements in global function and quality of life of patients with rheumatoid arthritis.

Acknowledgements

We wish to thank Branimir Kraljević, Veljko Jovanić, Predrag Stošić, Danijel Milosavljević, Voin Brković for their support and help to perform this study.

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Received on September 1, 2015.
Revised on November 25, 2015.
Accepted on December 17, 2015.
Online First June, 2016.