



Anti-rheumatic therapy effecting clinical outcomes of total hip arthroplasty

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Abstract

Introduction Total hip arthroplasty (THA) is an effective treatment for end-stage hip joint involvement in patients with rheumatoid arthritis (RA), reducing pain and improving function. However, systemic inflammation, secondary osteoporosis, and the specific nature of antirheumatic therapy can complicate surgical treatment of the patients. Understanding the interrelationships between standard therapy options is crucial for optimizing perioperative management and improving clinical outcomes of THA.

The **objective** was to evaluate the impact of different variants of disease-modifying anti-rheumatic therapy on postoperative outcomes of THA patients with rheumatoid arthritis.

Material and methods A review of 314 clinical cases of primary THA was performed. The study included patients with RA ($n = 194$) and involutonal arthrosis (IA) ($n = 120$). The parameters assessed included radiographic changes (Kellgren-Lawrence and Paprosky classifications, cortical index), surgical treatment, intraoperative blood loss, surgical outcomes, complication rate, pain dynamics evaluated with VAS, joint function assessed with the Harris Hip Score, RA severity assessment using the DAS28, and the quality of life (QoL) using the HAQ questionnaire.

Results RA patients were characterized by more pronounced acetabular defects and a reduced cortical index compared to IA patients ($p < 0.0001$). The use of disease-modifying antirheumatic drugs was associated with better bone structure preservation, while long-term glucocorticosteroid therapy was associated with worsening radiographic parameters and greater blood loss. Intraoperative blood loss was higher in RA with the use of glucocorticosteroids and nonsteroidal anti-inflammatory drugs. Both groups showed improved clinical outcomes, decreased pain, and improved joint function at three months of THA; however, IA patients achieved more significant results.

Discussion The findings suggested the key role of systemic inflammation and the nature of antirheumatic therapy in determining surgical risks and functional outcomes of endovascular knee replacement. The type of antirheumatic therapy effecting intraoperative features of endovascular knee replacement and surgical outcomes were also highlighted.

Conclusion THA is a surgical treatment modality that can improve clinical, functional outcomes and quality of life of RA patients. Long-term steroid therapy has a detrimental effect on bone tissue, complicating the surgery and increasing intraoperative blood loss.

Keywords: rheumatoid arthritis, total hip arthroplasty, perioperative management, disease-modifying antirheumatic drugs

For citation: Khasanov ER, Akhtiamov IF, Lapshina SA. Anti-rheumatic therapy effecting clinical outcomes of total hip arthroplasty. *Genij Ortopedii*. 2026;32(3):278-287. doi: 10.18019/1028-4427-2026-32-3-278-287.

INTRODUCTION

Total hip arthroplasty (THA) is one of the most effective surgical treatments for patients with late-stage hip disease, including rheumatoid arthritis (RA). Rheumatoid patients requiring hip arthroplasty display chronic systemic inflammation, use antirheumatic medications for a long term. This cohort of patients is characterized by pronounced osteoporotic and degenerative changes in bone and soft tissues increasing the technical complexity of the intervention and the risk of perioperative complications [1–3]. The most pronounced changes are observed in highly active forms of RA being associated with long-term use of glucocorticosteroids (GCS). The immunosuppressive effect of GCS and systemic inflammation are associated with a greater risk of infectious complications and delayed soft tissue healing after THA compared to patients with degenerative joint diseases [1, 4]. Patients with RA are at increased risk of developing infections compared subjects with other rheumatic diseases, and TKA is associated with greater risk of postoperative complications than THA [1]. RA patients are at increased risk of perioperative fractures and deep vein thrombosis, which is associated with the combined effects of systemic inflammation, osteoporosis, and drug-induced changes in the bone and muscles [5, 6]. Therefore, perioperative management of the commonly used drugs in patients with rheumatic diseases remains controversial. The dose of GCS is to be minimized in the perioperative period (no more than 10 mg of prednisolone per day) to reduce the risk of postoperative complications [7, 8].

The use of nonsteroidal anti-inflammatory drugs (NSAIDs) also remains a subject of debate. Long-term use of NSAIDs may negatively affect connective tissue regeneration, while short-term courses are considered relatively safe [9]. Some studies indicate an Ketorolac can be associated with an increased risk of infectious complications with its pronounced analgesic effect [10, 11]. Disease-modifying antirheumatic drugs (DMARDs), including methotrexate, leflunomide, and sulfasalazine, demonstrate a more favorable safety profile in the perioperative period. They can be recommended for continuous use in RA patients undergoing THA, since it does not increase the risk of infectious complications and helps reduce disease activity [12–14]. With the significant amount of accumulated data, the issues of optimal and safe use of antirheumatic drugs in the perioperative period in RA patients undergoing THA remain open and require further study.

The **objective** was to evaluate the impact of different types of basic anti-rheumatic therapy on postoperative outcomes of THA patients with rheumatoid arthritis.

MATERIAL AND METHODS

Clinical cases of THA were reviewed. The analysis included data from 314 patients who underwent surgery, 194 of whom were diagnosed with rheumatoid arthritis (RA) and 120 with involutinal arthritis (IA) of the hip. The study was based on the review of medical records, including outpatient charts, initial examination data, reports from specialized specialists, including rheumatologist, surgical protocols, and hospital discharge summaries. Follow-up examinations by an orthopedist and rheumatologist were performed according to standard procedures: preoperatively, upon hospital admission, and at three-month follow-up.

The study included patients over 18 years of age with destructive hip joint disease of rheumatoid or involutinal (non-systemic degenerative) origin who underwent THA. total hip arthroplasty have traditionally been considered to be Severe destructive joint lesions (Kellgren-Lawrence stages III and IV) or less severe stage II osteoarthritis refractory to conservative treatment were indications for THA. Exclusion criteria included hip osteoarthritis associated with other systemic musculoskeletal diseases or post-traumatic lesions requiring THA, incomplete clinical follow-up, and a lack of sufficient medical documentation to assess the patient's progress. Rheumatological examination was performed for RA patients several weeks before surgery with mandatory assessment of disease activity using the DAS28 scale and adjustment of therapy if necessary, during hospitalization, before discharge from the hospital and three months after surgery.

The gender and age distribution of patients was consistent with literature data (Table 1). The age of patients was 56.0 ± 12.0 years in the RA group and 60.04 ± 13.2 years in patients with involutational arthrosis. RA was significantly more common in women, while in the IA group the gender distribution of patients was approximately equal. Patients with RA were younger on average, reflecting an earlier need for surgical treatment in this nosology. A large proportion of RA patients (50.5%) were of working age (41–60 years), emphasizing the social significance of this disease.

Table 1

Gender and age characteristics of patients

Description		RA patients (<i>n</i> = 194)		IA patients (<i>n</i> = 120)		<i>p</i>
		abs.	%	abs.	%	
Gender	male	60	30.9	54	45.0	0.012
	female	134	69.1	66	55.0	0.012
Age	18–40 years	20	10.3	10	8.3	0.52
	41–60 years	98	50.5	42	35.0	0.048
	> 61 years	76	39.2	68	56.7	0.027

Note: *p*, significance level ($p < 0.05$) — statistically significant difference between the group indicators.

Clinical characteristics of RA were assessed taking into account the serological status, including the presence of rheumatoid factor (RF) and disease activity according to the DAS28 scale (Table 2).

The severity of osteoarthritis was assessed using the Kellgren-Lawrence radiographic classification (Table 3). No statistically significant differences were found between the RA and IA groups; all *p* values exceeded 0.05. Thus, the distribution of arthrosis grades in the groups can be considered comparable.

Table 2

Rheumatological status of patients

Criteria		RA patients (<i>n</i> = 194)	
		abs.	%
Seropositivity	RF (+)	121	62.4
	RF (–)	73	37.6
DAS28	< 2,6	26	13.4
	2,6–3,2	23	11.9
	3,2–5,1	106	54.6
	> 5,1	39	20.1

Table 3

Severity of OA graded by Kellgren-Lawrence system

OA grades	RA patients (<i>n</i> = 194)		IA patients (<i>n</i> = 120)		<i>p</i>
	abs.	%	abs.	%	
II	12	6.2	9	7.5	0.65
III	123	63.4	70	58.3	0.35
IV	59	30.4	41	34.2	0.49

Note: *p*, significance level ($p < 0.05$), statistically significant difference between the group indicators.

Analysis of drug therapy included the use of disease-modifying antirheumatic drugs (DMARDs), glucocorticosteroids (GCS), and nonsteroidal anti-inflammatory drugs (NSAIDs) (Table 4). DMARDs were used significantly more frequently, with methotrexate at doses of 7.5–15 mg per week being the leading drug; leflunomide and sulfasalazine were used less frequently. GCS therapy primarily included methylprednisolone and prednisolone. Methylprednisolone dosages were used at prednisolone-equivalent doses. NSAIDs were prescribed at average therapeutic doses. All patients received standard anticoagulant prophylaxis: unfractionated heparin in a hospital setting, followed by oral or injectable anticoagulants in the outpatient period for up to 35 days after surgery.

Table 4

Distribution of patients according to drug treatment

Type of therapy		RA patients (<i>n</i> = 194)	
		abs.	%
Basic therapy	GCS	37	19,1
	DMARD	87	44,8
	DMARD + GCS	70	36,1
NSAIDs administered	with NSAIDs	169	87,1
	No NSAIDs	25	12,9

A combination of clinical, instrumentation and questionnairing methods was used, along with an assessment of the anatomy of the joint lesion assessed to objectively evaluate the effectiveness of THA combined with antirheumatic therapy. Assessment of bone quality was the most important aspect of preoperative planning. For this purpose, acetabular defects were graded using the Paprosky classification and the cortical index (CI) of the proximal femur using plain pelvic radiography. The characterization of the surgical intervention included the type of implants, fixation method, the need for bone grafting or additional stabilization of components, the duration of the operation, and the volume of intraoperative blood loss. The frequency and structure of postoperative complications, including infectious and thromboembolic events, instability, and aseptic loosening of implants were assessed. Pain intensity was evaluated with the visual analog scale (VAS), and the Harris Hip Score measured the hip functionality. Rheumatoid arthritis activity was assessed using the DAS28 index, and patients' quality of life evaluated using the HAQ Disability Index. The scales and questionnaires used are validated and widely used in clinical practice in rheumatology and orthopedics. Clinical assessments were performed preoperatively upon admission to the hospital and three months after THA.

The study was conducted in accordance with the ethical standards set forth in the Helsinki Declaration of the World Medical Association and with the principles of confidentiality of personal data. The study protocol was approved by the local ethics committee of the Kazan State Medical University of the Ministry of Health of the Russian Federation (Protocol no. 8 dated 14.10.2025). Statistical data processing was performed using Microsoft Excel and Statistica 10.0 (StatSoft Inc., USA). Descriptive analysis (mean values, standard deviations, median, interquartile range) was produced. Nonparametric methods were used to assess differences, including calculation of 95 % confidence intervals using the Wilson method for related samples and the χ^2 test for categorical features, Student's t-test with Welch's correction for comparison of mean values. The critical level of statistical significance was considered to be $p < 0.05$.

RESULTS

Radiographs and intraoperative examination of injured joint showed that RA patients had a more pronounced decrease in bone density in combination with cortical intra-articular and subcortical defects. Acetabulum condition was of the greatest clinical and surgical significance. Comparative analysis (Table 5) revealed significant differences in the prevalence of acetabular defects between RA and IA patients. Acetabular defect was absent in 73.3 % of patients without a systemic inflammatory process (95 % CI: 64.8–80.6 %), indicating predominantly preserved anatomy of the hip joint. This indicator was significantly lower and amounted to 29.9 % in RA patients (95 % CI: 23.5–36.4 %). The differences between the RA and IA groups were statistically significant ($p < 0.0001$).

Table 5

Defects of the hip joint as graded by W. Paprosky (1994)

Type of defect	RA patients (<i>n</i> = 194)	IA patients (<i>n</i> = 120)	<i>p</i> (RA/IA)
	Abs. (%) [CI]		
No defect	58 (29.9 %) [23.5–36.4 %]	88 (73.3 %) [64.8–80.6 %]	< 0.0001
I	60 (30.9 %) [24.4–37.4 %]	16 (13.3 %) [7.8–21.3 %]	< 0.001
II A	50 (25.8 %) [19.7–32.0 %]	12 (10.0 %) [5.4–17.0 %]	< 0.001
II B	15 (7.7 %) [4.0–11.5 %]	2 (1.7 %) [0.2–6.0 %]	0.01
II C	10 (5.2 %) [2.0–8.3 %]	2 (1.7 %) [0.2–6.0 %]	0.09
III A	1 (0.5 %) [0–1.5 %]	0	1.0
III B	0	0	–

Distribution of acetabular defects as graded by Paprosky showed a predominance of type I and IIA defects in RA patients, which were detected in 30.9 % and 25.8 % of cases, respectively. with, Similar defects were less common in IA patients and were observed in 13.3 % and 10.0 % of cases with the differences between the groups being statistically significant ($p < 0.001$). The findings suggested the significant role of chronic systemic inflammation in the formation of early structural changes in the acetabulum. More severe defects (IIB and IIC) were more common for RA patients (7.7 % and 5.2 %) compared to the IA group (1.7 % and 1.7 %, respectively). For type IIC defects, the differences did not reach the level of statistical significance ($p = 0.09$). Severe grade IIIA and IIIB acetabular defects were rare and did not allow for reliable intergroup differences. Thus, RA patients exhibited more pronounced and varied structural abnormalities of the acetabulum compared to IA cases, which was essential for preoperative planning of THA.

Radiographic markers of bone mass deficiency (cortical index (CI) and acetabular defects) were analyzed depending on the therapy considering the known negative effect of GCS on bone tissue and the potential osteotoxic effect of DMARDs and NSAIDs. The cortical index was calculated using a plain pelvic radiograph, approximately 10 cm distal from the lesser trochanter, and by relating the external bone diameter (D) to the diameter of the medullary canal (C) using the formula: $CI = (D - C) / D$. The average CI values in RA patients depended on the treatment option (Table 6). The highest values were observed in patients receiving DMARD monotherapy (0.43 ± 0.035), which was significantly higher compared to the GCS group (0.380 ± 0.025); $p < 0.0001$). Combination therapy (DMARDs + GCS) did not lead to a significant improvement in the CI compared to GCS monotherapy ($p \approx 0.07$), suggesting that the positive effect of DMARDs is leveled with the addition of GCS.

The CI values were significantly lower in all subgroups of RA patients than in IA patients (0.510 ± 0.037); $p < 0.0001$ suggesting more pronounced structural changes in bone tissue during the systemic inflammatory process, regardless of therapy.

Table 6

Mean values of femoral cortical index among patients

Average, SD				<i>p</i>	
RA patients (<i>n</i> = 194)			IA patients (<i>n</i> = 120)	(GCS/DMARD)	< 0.0001
GCS (<i>n</i> = 37)	DMARD (<i>n</i> = 87)	DMARD + GCS (<i>n</i> = 70)		(GCS/DMARD+GCS)	0.07
0.38 ± 0.025	0.43 ± 0.035	0.39 ± 0.031	0.51 ± 0.037	(GCS/IA)	< 0.0001

Note: $p < 0.05$, statistically significant difference between the indicators in groups and subgroups.

Distribution of acetabular defects as graded by Paprosky depending on therapy showed that the highest proportion of preserved acetabular structure was observed in the DMARD group of RA patients and the indicator was minimal with GCS monotherapy ($p = 0.03$). Combination therapy did not provide a significant advantage compared with GCS. The use of DMARDs was associated with a lower prevalence of severe defects, while long-term use of GCS was accompanied by deterioration of the acetabular structure. THA was performed using a standard technique and a posterolateral approach in both groups. Endoprostheses from leading manufacturers were employed and the choice was determined by the patient's age, bone quality, and severity of the lesion. Uncemented THA was used in 82.5 % of cases and cemented procedure applied in 17.5 %.

Uncemented THA was more common in IA (90.8 %) than in RA (76.8 %) which was associated with a higher prevalence of secondary osteoporosis and end-stage joint damage. A cortical index < 0.35 was considered one of the key criteria for cemented fixation. Acetabular defects of grade II and higher

required bone grafting. The use of autografts and additional screw fixation was more common for RA patients including type IIA defects. Screw fixation was used for 23–25 % of RA patients and for 5% in IA ($p < 0.001$).

Intraoperative blood loss is a key factor affecting the duration of surgery and postoperative course, particularly in endovascular THA in RA patients. Review of surgical protocols revealed that blood loss was higher in RA patients than in IA patients: (345 ± 108) ml in the RA group versus (250 ± 85) ml in the IA group. RA patients were more likely to experience diapedetic bleeding from soft tissues and the bone, indicating hemostasis disorders. To clarify the role of medications, RA patients were examined with regard to their use of NSAIDs and GCS. RA was accompanied by a tendency towards greater blood loss that measured (270 ± 52.5) ml (95 % CI: 265–275 ml) in RA patients without NSAIDs ($n = 25$) and (250 ± 50) ml (95 % CI: 245–255 ml; $p > 0.05$) in IA patients without NSAIDs ($n = 38$).

The use of NSAIDs resulted in a significant increase in blood loss in both RA and IA. Blood loss measured (380 ± 85) ml (95 % CI: 372–388 ml) in RA patients receiving NSAIDs ($n = 169$) which was significantly higher compared to patients without NSAIDs ($p < 0.0001$). Similar dynamics were noted in IA: (340 ± 75) ml versus (250 ± 50) ml, $p < 0.0001$. The use of NSAID was associated with an increase in intraoperative blood loss by an average of 30–35%. GCS therapy had the most pronounced effect. Blood loss was (450 ± 75) ml (95 % CI: 442–458 ml) in RA patients receiving GCS ($n = 107$) and (310 ± 45) ml (95 % CI: 306–314 ml; $p < 0.0001$) in no-GCS subjects. NSAID discontinuation never happened in this subgroup, which reflects real clinical practice. Non-overlapping confidence intervals confirm the statistical stability of the identified differences.

Clinically, increased bleeding in RA patients in the context of GCS was manifested by difficult-to-control bleeding and a greater need for blood transfusion. Transfusion of fresh frozen plasma was required in 10.3 % of RA patients, and red blood cell transfusion in 4.1%, and the figures were 7.5 % and 4.2 % in IA patients, respectively. Postoperative complications were more common in RA patients and included delayed soft tissue healing: 15.5 % in the RA group (95 % CI: 10.4–20.6 %) and 9.2 % in IA (95 % CI: 3.9–14.5 %). Compared with IA, there was a tendency towards an increase in frequency ($p = 0.09$).

Periprosthetic joint infection, thromboembolic complications, periprosthetic fractures, and implant dislocations were rare (no more than 0–5.9 %) and there were no statistically significant differences between the groups ($p > 0.05$). The most pronounced differences were noted in hip contractures: 12.3 % in RA patients versus 3.3 % in IA patients, with a statistically significant difference of $p = 0.01$. The impact of THA on clinical outcomes was explored by evaluating pain severity, functional activity, RA activity and quality of life. A decrease in pain severity measured with the VAS was noted early after THA, and minimal pain values were recorded in both groups three months after the surgery (Fig. 1). This indicates the high efficacy of THA as a pain relief method and high patient satisfaction with the treatment results for both RA and IA.

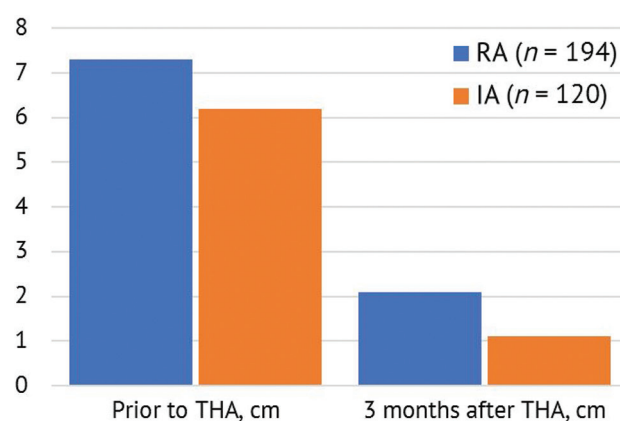


Fig 1 Dynamics of changes in average VAS pain scores

The baseline VAS pain score before surgery averaged to 7.3 cm in RA patients with ($n = 194$). The pain intensity score decreased to an average of 2.1 cm three months after THA, which corresponded to an absolute pain reduction of approximately 5.2 cm. The differences between pre- and postoperative values were statistically significant ($p < 0.0001$), indicating a pronounced analgesic effect of THA in RA patients. The preoperative pain score was (6.2 ± 1.95) cm in IA patients ($n = 120$) and decreased to (1.1 ± 0.95) cm at three-month follow-up. The mean pain score reduction reached 5.1 cm (95 % CI 4.75–5.45) with the differences being highly statistically significant ($p < 0.0001$).

An intergroup comparison revealed significant differences in pain intensity at three-month follow-up. Pain levels in RA patients were statistically higher than in IA patients (2.1 vs. 1.1 cm; $p < 0.0001$). Thus, THA was associated with a significant pain relief in RA and IA patients, with minimal pain severity observed post-op in the involutional arthrosis group.

Functional activity measured with the Harris Hip Score significantly improved in both groups three months after THA (Fig. 2). The mean Harris Hip Score increased from (65.8 ± 9.9) to (90.4 ± 7.4) in RA patients ($n = 194$) which corresponded to an increase of 24.6 scores. The differences between pre- and postoperative scores were statistically significant ($p < 0.0001$). IA patients showed the most pronounced improvement in functional activity: the score increased from (64.1 ± 9.4) to (94.5 ± 5.4) ($\Delta = 30.4$; $p < 0.0001$). Between-group analysis revealed statistically significant differences in functional recovery three months after THA. The Harris Hip Score was lower in RA patients than in IA patients (90.4 vs. 94.5 scores; $p < 0.0001$), suggesting an influence of the systemic inflammatory process in RA on the extent of functional recovery after surgery.

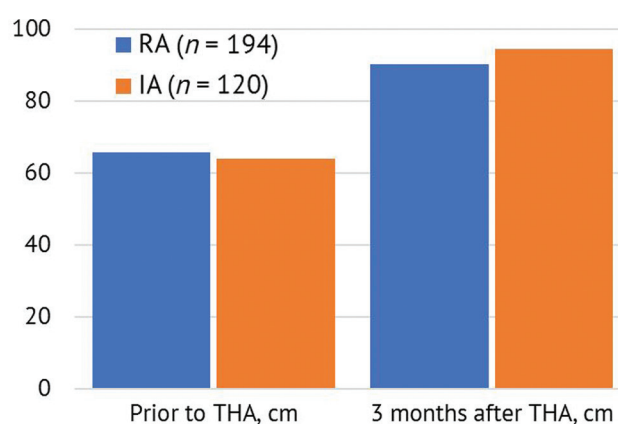


Fig. 2 Dynamics of changes in average hip function measured with the Harris Hip Score

Additional assessment of activity using the DAS28 index in RA patients showed a significant decrease in inflammatory disease activity after THA. The average decrease in the DAS28 score was 2.3 (from (4.7 ± 0.82) to (2.4 ± 0.54); $p < 0.00001$), indicating a significant decrease in disease activity in the postoperative period. Quality of life measured with the short-HAQ scale revealed positive dynamics in RA patients post-op. The value decreased from (1.73 ± 0.54) to (1.41 ± 0.37), which suggested an improvement of 0.32 score ($p < 0.00001$; 95% CI 0.25–0.39). Thus, THA in RA patients was accompanied by a significant improvement in functional activity, in quality of life, a decrease in the inflammatory activity of the disease, but the extent of functional recovery remained somewhat lower compared to IA patients.

DISCUSSION

Our findings showed that RA patients had more pronounced structural abnormalities of the acetabulum and reduced CI compared to IA subjects. This is consistent with the literature data, according to which RA patients have a high incidence of osteopenia and osteoporosis due to the chronic inflammatory process and the influence of concomitant therapy, glucocorticosteroids,

in particular, a factor associated with accelerated bone loss and an increased risk of surgical complications after arthroplasty. A large systematic review demonstrated that patients with low bone mineral density have a higher risk of adverse events after THA, including a greater incidence of transfusions and complications, although quality of life and patient-oriented outcomes may be comparable to those of patients with normal bone density. This emphasizes the clinical significance of preoperative assessment of the bone status [15].

Our findings on the higher frequency of acetabular defects in RA patients are supported by studies reporting systemic inflammation as a cause of more profound structural changes in joints and bone tissue, complicating the technical aspects of arthroplasty and increasing the likelihood of bone grafting. These pathological aspects including Paprosky IIA defects and higher can correlate with a higher frequency of mechanical interventions and additional fixators, which is supported by literature data on the complexity of surgical reconstructions in patients with bone deficiency [16].

Uncemented THA and screws were commonly used fixation in RA, being consistent with the findings of a systematic review reporting that RA patients maintain comparable survival rates of uncemented components, but are potentially more likely to experience mechanical complications (such as fractures or migration) with impaired bone structure [3]. Bone grafting of defects using autogenous materials was performed in our series, allografts were less common often using [17]. These methods including screws allowed for more reliable fixation of the acetabular component in THA.

Postoperative outcomes of THA in our series were associated with pain relief, improved function and quality of life and are supported both by our sample and by a meta-analysis reporting that RA patients experience significant improvement in pain and function after surgery, despite an increased risk of some complications, compared to OA patients [18]. Finally, our data on the effect of NSAIDs and GCS on intraoperative blood loss reflects the known mechanism of hemostatic impairment by the drugs to be explored in larger cohort studies. The impact of antirheumatic therapy remains controversial, and there are reports of increased bleeding in patients with systemic inflammation and of NSAIDs and GCS effecting on hemostasis and postoperative risks [19–21], while other studies report a reduction or absence of risks with rationally selected treatment [22, 23].

CONCLUSION

THA in patients with rheumatoid arthritis is associated with more pronounced bone changes and increased bleeding, which depend on the type of underlying therapy. However, the use of DMARDs facilitates more favorable bone condition and reduced blood loss. The surgery leads to a significant reduction in pain, improved joint function, and improved quality of life, despite a higher risk of certain complications compared to involutional arthrosis.

Conflict of interest None of the authors has any potential conflict of interest.

Funding The study was supported by a grant from the Kazan State Medical University, a federal state budgetary educational institution of higher education, and the Priority 2030 State Program. The study protocol was approved by local ethics committee of the Kazan State Medical University's (Protocol no. 8, dated October 14, 2025).

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The article was submitted 19.01.2026; approved after reviewing 20.03.2026; accepted for publication 06.04.2026.

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