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Comparation of the perioperative clinical characteristics during total hip arthroplasty of patients with rheumatoid arthritis and ankylosing spondylitis

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Abstract

Objective Total hip arthroplasty (THA) has been applied as a successful treatment for repairing the impaired hip joints of patients with advanced inflammatory arthritis. Few studies compared the inpatient clinical characteristics of these patients receiving THA due to inflammatory arthritis. This study aims to compare the perioperative clinical outcome of patients receiving THA due to rheumatoid arthritis (RA) or ankylosing spondylitis (AS).

Methods We retrospectively included 60 patients receiving THA due to RA or AS, and compared their inpatient clinical characteristics. The collected data comprised baseline data including gender, age, body mass index (BMI), blood pressure, Barthel index and clinical outcomes including operative time, perioperative blood loss, perioperative inflammatory indicators, length of hospitalization, inpatient medicine cost and perioperative complications.

Results AS patients showed increased operative blood loss and autologous transfusion rate than the RA patients. In addition, RA patients showed increased serum level of erythrocyte sedimentation rate (ESR) and interleukin-6 (IL-6), while no significant difference was found between the two groups in length of hospitalization, medicine cost and perioperative complications.

Conclusion We suggested that more attention should be paid to the blood loss management of AS patients during perioperative stage, since AS patients were more susceptible to blood loss during THA with the potential reason to remove large amounts of osteophyte.

Keywords THA, Rheumatoid arthritis, Ankylosing spondylitis, Perioperative outcome

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Background

Total hip arthroplasty has been an effective treatment for treating degenerative hip arthritis, femoral neck fracture, or traumatic hip arthritis, which usually occurred in the elderly patients. Recently, in addition to these degenerative diseases, some younger patients suffering from inflammatory diseases began to require THA to relieve continuous hip pain and restore hip function.

There are two major inflammatory diseases including rheumatoid arthritis (RA) and ankylosing spondylitis (AS) that would progress to impair the hip joint of younger patients. RA is a long-term autoimmune disorder mainly manifesting with synovitis in joints, and this disease would progress to cause cartilage damage, continuous joint pain and dysfunction over the disease course [1]. It was reported that more than 50% of RA patients had received orthopedic surgery, and up to 25% of them had undergone lower limbers total joint arthroplasty [2, 3]. In recent years, the application of disease modifying anti-rheumatic drugs (DMARDs) for managing RA patients has improved their life quality and slow the disease progression significantly [4, 5]. However, Kemjika O. Onuoha et al. analyzed the annual prevalence of THA in RA patients and found no significant decrease from 2002 to 2013 [6]. Therefore, THA should be an effective and reliable treatment for restoring the impaired hip joints and improving the quality of life of RA patients [6, 7].

AS is also a chronic autoimmune disease which is mainly characterized by the inflammation of the axial spine and sacroiliac joints [8]. The hip joint is one of the most common affected joints in AS patients, with 30–50% incidence rate among AS patients [9]. Different from the RA disease, the pathomechanism of AS disease is the localized inflammation at the ends of tendon and ligaments, as well as the joint capsule [10]. With the progress of disease, the affected hip joints would get ossified histologically and will eventually show continuous pain, joint stiffness and fixed flexion contracture clinically [11]. THA has been identified as a standard treatment for AS patients with severe hip damage to relieve the pain and restore the mobility function of impaired hip joints.

Although the two diseases are both autoimmune disorders, the pathological mechanisms of these two diseases are totally different. As such, there are great difference between the treatment for the two diseases. While THA can be an effective surgical treatment for patients with RA or AS when the two diseases involved the hip joint. It was worth noting that there were little clinical studies to compare the clinical perioperative characteristics between RA patients and AS patients.

Herein, in this study, we retrospectively collected the clinical perioperative data of RA or AS patients receiving THA in our hospital over the last 5 years, and the aim of this study was to detected if there were any clinical difference between the two groups of patients receiving THA.

Patients and methods

Patients

This retrospective study was carried out in a comprehensive high-capacity hospital with over 400 THA performed annually. The orthopedists in the joint surgery department were mostly experienced in the arthroplasty for patients with RA or AS. We retrospectively collected the clinical data of patients in our hospital receiving THA due to rheumatoid arthritis or ankylosing spondylitis from January 2016 to December 2019. The patients in our hospital were diagnosed with RA according to the 2010 Rheumatoid Arthritis Classification Criteria [12]. And the patients suffering from AS were identified according to the New York clinical criteria for ankylosing spondylitis [13]. Following the initial diagnosis by orthopedic surgeons, all patients were referred to rheumatologists for confirmation of diagnosis and preoperative medical optimization, including disease-modifying therapy adjustments, in accordance with national guidelines. All patients underwent preoperative lower-extremity venous Doppler ultrasound to exclude preexisting deep venous thrombosis (DVT). Exclusion criteria included: (1) Incomplete perioperative records; (2) Preoperative diagnosis of DVT; (3) Concurrent systemic infections, malignancies, or decompensated chronic diseases; (4) THA and perioperative management performed by non-designated surgical teams. A total of 37 patients receiving THA due to RA were finally included in this study. And a total of 23 patients receiving THA due to AS were finally included in our study. All the patients received disease-specific medical management under rheumatological supervision prior to THA. All the patients preoperatively provided with the written informed consent to the THA surgery. All the THA surgeries were performed by two lead experienced orthopedic surgeons, who supervised the entire surgical team. The study was approved by the Ethics committee in our hospital (proof number: 202008109). A comprehensive agreement for academic use of information collected above was obtained from the patients by our hospital at the time of their hospitalization. No identifiable information of the participants is included in this paper.

Surgical technique

All patients underwent the conventional THA by two lead experienced orthopedic surgeons, supported by two assisting surgeons in our joint surgery department. All patients were anesthetized by general anesthesia and the posterior approach was adopted for all patients. An incision approximately measuring 10 cm at length was made, beginning from 4.5 cm distal and lateral to the posterior

superior iliac spine, continuing laterally and distally and keeping parallel with the fibers of the gluteus maximus muscle, passing through the posterosuperior angle of the greater trochanter and extending 5 cm to the distal end along the posterior edge trochanter. Then the gluteus maximus fibers were separated less than 7 cm parallel with the skin incision, and the muscle masses were retracted forward and backward to expose the greater trochanter and gluteus medius. Then the gluteus medius and miniums, piriformis and gemellus muscles were detached successively near their insertions at the greater trochanter and retracted medially to expose the hip capsule. The hip capsule of all patients was removed clearly, and the acetabular cup, femur stem, head and liner were successively placed. After suturing the incision, no drainage tube but a moisture-proof and breathable dressing was placed. Intraoperative transfusion decisions were made jointly by the surgical and anesthesia teams based on intraoperative blood loss, hemodynamic stability, and hemoglobin levels, following national perioperative blood management guidelines, aligned with the 2023 AABB International Guidelines [14].

Data collection

We collected the perioperative data of patients from the electronic medicine system in our hospital. The preoperative data of patients, including gender, age, body mass index (BMI), blood pressure, was collected. And the preoperative clinical examination data, including the Barthel scale and Caprini score, was also collected. Preoperative inflammatory (CRP: C-reactive protein, ESR, IL-6, PCT: Procalcitonin) and coagulation (PT: Prothrombin time, APTT: Activated partial thromboplastin time, D dimer) markers were retrieved from laboratory records to establish baseline profiles. While disease duration and medication regimens were not systematically documented, all patients received guideline-directed medical management under rheumatological supervision. The intraoperative and postoperative data, including the operative time, amount of bleeding, length of postoperative hospital stay, total medicine costs, blood inflammatory factors, coagulation indicators and perioperative complications was collected. Postoperative functional assessment, the Barthel Index, was performed systematically on the day of discharge to evaluate recovery status prior to hospital discharge.

Statistical analysis

All data analysis was performed using the SSPS software with the Statistical Package for the Social Sciences (SPSS 12.0, Chicago, IL, USA). The qualitative data was expressed as occurrence number and percentage, and the Chi squared and Fisher's exact tests were applied for its statistical analyses. The quantitative data was expressed as mean ± standard deviation, and the student's t test was applied for its statistical analyses. A $P<0.05$ was considered statistically significant.

Results

The preoperative data of included patients were summarized in the Table 1. A total of 37 patients in the RA group and 23 patients in the AS group were included in this study. Patients in the AS group were much younger than those in the RA group (RA: 55.78 ± 9.70 vs. AS: 43.30 ± 13.03 years; $P<0.01$), and the proportion of female patients was lower in the AS group (RA: 24/13 vs. AS: 8/15; $P=0.0336$). Patients in the AS group possessed a lower systolic blood pressure (SBP) ($P=0.0021$) and diastolic blood pressure (DBP) ($P=0.0141$). Patients in the AS group also had significantly lower Caprini scores

Table 1 Preoperative data of included patients

	RA (37)	AS (23)	*P* value	Significance
Age (year)	55.78 ± 9.70	43.30 ± 13.03	$P<0.01$	**
Female: Male	24:13	8:15	0.0336	*
BMI (kg/m^2)	22.09 ± 2.98	22.02 ± 3.79	0.9368	ns
SBP (mmHg)	132.83 ± 16.50	115.43 ± 20.95	0.0021	**
DBP (mmHg)	79.51 ± 11.15	72.34 ± 9.82	0.0141	*
Barthel index	83.64 ± 16.70	75.43 ± 19.22	0.0859	ns
Caprini score	8.19 ± 0.73	7.35 ± 0.76	$P<0.01$	**
ESR (mm/h)	22.75 ± 3.39	20.26 ± 5.87	0.0687	ns
CRP (mg/L)	22.44 ± 8.16	19.69 ± 5.37	0.1146	ns
IL-6 (ng/L)	9.49 ± 2.41	11.25 ± 5.32	0.1406	ns
PCT (ng/mL)	0.08 ± 0.06	0.11 ± 0.08	0.1231	ns
PT (s)	11.93 ± 0.88	12.28 ± 0.91	0.1470	ns
APTT (s)	33.26 ± 4.46	32.12 ± 5.36	0.3980	ns
D dimer (mg/L)	0.48 ± 0.24	0.55 ± 0.18	0.2024	ns

SBP: systolic blood pressure, DBP: diastolic blood pressure, BMI: body mass index

*: $P<0.05$; **: $P<0.01$; ns: non-statistical difference

Table 2 Intraoperative data

	RA (37)	AS (23)	*P* value	Significance
Operating time (min)	142.29 ± 43.65	142.05 ± 69.43	0.9870	ns
Intraoperative blood loss (ml)	273.93 ± 291.76	486.95 ± 295.33	0.0082	**
Intraoperative RBCs transfused (n/%)	2/5.41	9/39.13	0.0017	**
Intraoperative transfusion rate (n/%)	18/48.64	18/78.26	0.0310	*

*: *P*<0.05; **: *P*<0.01; ns: non-statistical difference

Table 3 Clinical outcome

	RA	AS	*P* value	Significance
Postoperative Barthel index	66.67 ± 10.63	64.77 ± 11.22	0.5062	ns
ESR (mm/h)				
Postoperative 1 day	49.85 ± 32.98	32.17 ± 21.28	0.0258	*
Postoperative 3 days	87.89 ± 29.37	63.75 ± 23.36	0.0015	**
CRP (mg/L)				
Postoperative 1 day	57.34 ± 34.84	61.55 ± 22.66	0.6087	ns
Postoperative 3 days	60.22 ± 33.17	61.73 ± 26.80	0.8547	ns
IL-6 (ng/L)				
Postoperative 1 day	88.53 ± 68.63	43.22 ± 27.15	0.0038	**
Postoperative 3 days	26.49 ± 15.41	31.25 ± 12.32	0.2159	ns
PCT (ng/mL)				
Postoperative 1 day	0.19 ± 0.19	0.10 ± 0.09	0.0162	*
Postoperative 3 days	0.11 ± 0.09	0.13 ± 0.06	0.3501	ns
PT (s)	12.98 ± 0.91	13.48 ± 0.85	0.0616	ns
APTT (s)	32.15 ± 4.49	36.02 ± 5.09	0.0033	**
D dimer (mg/L)	0.89 ± 0.63	0.48 ± 0.10	0.0034	**

ESR: erythrocyte sedimentation rate, CRP: C-reactive protein, IL-6: interleukin- 6, PCT: procalcitonin, PT: prothrombin time, APTT: activated partial thromboplastin time

*: *P*<0.05; **: *P*<0.01; ns: non-statistical difference

than those in the RA group ($p < 0.01$). There was no significant difference between the two groups with respect to BMI, Barthel index and preoperative inflammatory markers and coagulation indicators.

Intraoperative data, including operating time, blood loss, autologous transfusion rate and red blood cell (RBC) transfusion rate, are summarized in Table 2. Although there was no significant difference between the two groups in operative time, a significant increase of operative blood loss was observed in the AS group (486.95 ± 295.33) compared with that of the RA group (273.93 ± 291.76). The operative RBC transfusion rate ($P = 0.0017$) and autologous transfusion rate ($P = 0.0310$) in the AS group were much higher than that of RA group.

The postoperative outcome of patients after THA were summarized in the Table 3. No significant difference of the postoperative Bathel scoring was found between the two groups. For the detection of blood inflammation indicators, a significant increase of blood ESR, IL-6 and PCT level at day 1 was detected in the RA group as compared with the AS group. While no significant difference was found between the two groups in the blood CRP level. At day 3, the patients of the RA group still showed increased blood ESR level than that of the AS group, but no significant difference of the blood PCT, ESR and IL-6 was found between the two groups. For the blood coagulation function test, there was no significant difference between the two groups in PT, while increased APTT and blood D-dimer level were detected in the RA group compared with the AS group. In addition, there was no significant difference detected between the two groups with respect to the length of hospital stay (LHS) and medical cost (Table 4). As for perioperative complications, there were 6 patients suffering from subcutaneous abdominal hemorrhage (SAS) (1), fracture (1), flexion contracture (1) and DVT (3) in the RA group after THA. While there were 2 patients complaining fracture after THA in the AS group. (Table 4).

Discussion

Inflammatory arthritis, especially AS and RA, would impair the cartilage and function of the hip joint with the disease progress. THA has been applied as a successful treatment for repairing the impaired hip joints of patients with advanced inflammatory arthritis. Up to now, most studies focused on the comparation of failure rate of THA between inflammatory patients and osteoarthritis patients, but few studies compared the inpatient clinical characteristics of these patients receiving THA due to inflammatory arthritis. In this study, we retrospectively

Table 4 Cost, length of stay and complication

	RA (37)	AS (23)	*P* value	Significance
Medicine Cost (dollar)	17088.13 ± 7650.25	17,806 ± 5424.43	0.6963	ns
LHS (day)	11.62 ± 3.94	9.70 ± 3.95	0.0719	ns
Complication (n/%)				
Total (n/%)	6/16.2	2/8.69	0.4564	ns
SAS	1/2.7	0/0	> 0.9999	ns
Fracture	1/2.7	2/8.69	0.5524	ns
Deep-vein thrombosis	3/8.1	0/0	> 0.2788	ns
Flexion contracture	1/2.7	0/0	> 0.9999	ns

LHS: Length of hospital stay; SAS: Subcutaneous abdominal hemorrhage; ns: non-statistical difference

compared the perioperative clinical outcome of patients receiving THA due to RA or AS.

For the comparation of preoperative data of the 2 groups, we found that the included AS patients were younger than the included RA patients, with more female patients in the RA group. The difference of sex and age composition ratio between the two groups was consistent with a comparative study comparing the quality of life between RA and AS patients [15]. In addition, we found that RA patients showed a higher SBP and DBP than AS patients. It was reported that RA patient showed an increased risk for cardiovascular disease [16]. And also, M J L Peters et al. reported that AS patients showed an increase risk for myocardial infarction [17]. Han C et al. found that both AS and RA patients showed increased risks for cardiovascular disease [18]. Due to the data availability, we were unable to compare the cardiovascular disease risk between the two groups, despite the difference in blood pressure between the two groups. This study did not analyze the prognostic impact of age, blood pressure, or gender on long-term outcomes (e.g., implant survival, functional recovery). Future prospective studies should incorporate multivariable models to dissect these relationships, particularly in light of the inherent demographic disparities between RA and AS populations [19–21]. The absence of preoperative intergroup differences in inflammatory/coagulation markers (Table 1) underscores that postoperative disparities (e.g., IL-6, D-dimer) likely reflect disease-specific responses to surgical stress, rather than baseline disease activity.

Our study demonstrated comparable operative times between RA and AS patients undergoing THA ($P = 0.9870$). However, AS patients exhibited significantly greater intraoperative blood loss compared to RA patients (486.95 ± 295.33 mL vs. 273.93 ± 291.76 mL, $P = 0.0082$). This disparity likely reflects the distinct surgical complexities inherent to AS. Specifically, AS patients frequently present with advanced hip ankylosis and extensive osteophyte formation, which necessitate meticulous dissection and prolonged soft tissue handling. Bhan et al. corroborated these challenges, reporting mean blood loss of 450 mL (range: 300–900 mL) in AS patients undergoing THA [22]. Furthermore, Li et al. emphasized that osteophyte resection and distorted acetabular anatomy in AS patients directly contribute to both prolonged operative time and hemorrhagic risks [23]. Blizzard et al. further stratified these findings, demonstrating that hip ankylosis—independent of osteophyte volume—is a critical determinant of perioperative blood loss [11]. Collectively, these anatomical and technical factors, rather than coagulation abnormalities or BMI differences (AS vs. RA BMI: 22.02 ± 3.79 vs. 22.09 ± 2.98 kg/m², $P = 0.9368$) [24], underpin the elevated bleeding observed in AS patients.

Postoperatively, one RA patient developed subcutaneous abdominal hematoma, though the incidence did not differ significantly between groups (2.7% vs. 0%, $P > 0.9999$). While RA is classically associated with coagulation dysfunction and hematoma predisposition [25], our analysis revealed no intergroup differences in prothrombin time (PT) (12.28 ± 0.91 s vs. 11.93 ± 0.88 s, $P = 0.1470$). Intriguingly, AS patients exhibited prolonged activated partial thromboplastin time (APTT) compared to RA patients (36.02 ± 5.09 s vs. 32.15 ± 4.49 s, $P = 0.0033$). This paradoxical finding suggests that AS-related bleeding may arise from surgical factors (e.g., fibrotic tissue adherence, extensive raw bone surfaces) rather than intrinsic coagulopathy. Standardized intraoperative hemostatic techniques—such as electrocautery, fibrin sealants, and compressive dressings—likely mitigated hematoma risks in both cohorts, despite their divergent coagulation profiles.

RA patients presented a higher baseline thrombotic risk profile, as evidenced by elevated Caprini scores (8.19 ± 0.73 vs. 7.35 ± 0.76, $P < 0.01$) and postoperative D-dimer levels (0.89 ± 0.63 vs. 0.48 ± 0.10 mg/L, $P = 0.0034$). Notably, however, no significant difference in deep vein thrombosis (DVT) incidence was observed between groups (8.1% vs. 0%, $P = 0.2788$). These results underscore the efficacy of standardized perioperative anticoagulation protocols—including preoperative risk stratification, intraoperative mechanical compression, and postoperative low-molecular-weight heparin—in neutralizing disease-specific thrombotic tendencies.

Given the increased blood loss in AS patients, 78.26% underwent autologous transfusion intraoperatively (vs. 48.64% in RA, $P = 0.0310$). To optimize perioperative outcomes, proactive blood management strategies are critical for AS patients. These may include tranexamic acid administration, preoperative autologous blood collection, and meticulous surgical planning to address anatomical challenges [23]. Such measures could further reduce transfusion demands and enhance safety in this high-bleeding-risk population.

As for the comparation of inflammatory index over the perioperative time, we found that the RA patients after THA showed higher ESR level in serum at day 1 and day 3, as well as higher IL-6 level at day 1, as compared with the AS patients after THA. While the patients of the two groups showed equivalent IL-6 level in serum at day 3. In addition, there were no significant difference between the two groups with respect to the ESR level in serum at postoperative 1 and 3 day. Although it seemed that in vivo inflammatory activities after operation was more severe in RA patients than AS patients, no significant difference was found in terms of incidence of inpatient complications, including DVT, hip stiffness, fracture and flexed contracture. Meanwhile, we found no significant difference between the two groups with respect to length of stay. Therefore, these inflammatory indicators may be not sensitive enough to predicate the occurrence of perioperative complications.

Collectively, these findings highlight the importance of tailored perioperative strategies for AS patients, particularly in blood management.

Strengths and limitations

Our study offers three key advancements: First, while existing literature focuses on inflammatory arthritis vs. osteoarthritis, the study pioneers a direct comparison between RA and AS in THA, revealing disease-specific challenges. We retrospectively included the patients receiving THA due to RA or AS in our hospital over the last five years, and we specially compared the perioperative clinical characteristics between the two groups. To ensure internal validity, all THA procedures were standardized to a posterolateral approach, performed by a designated surgical team, and followed identical perioperative protocols. This methodological rigor minimized variability unrelated to the diseases (RA vs. AS) themselves. Second, it demonstrates that RA patients' elevated thrombotic risk (per Caprini scores) does not translate to higher DVT incidence under standardized sugery and care. Third, it suggests that standardized management may neutralize baseline risk disparities between RA and AS patients, ensuring comparable complication rates across diverse inflammatory cohorts. Due to the data availability, however, the presence of some limitations of this study was inevitable and should be noted when generalizing our conclusion. Firstly, there were only a total of 60 patients included in this study. The small sample size would impair the evidence level of this study. Secondly, we only collected the perioperative clinical data of these included patients, and the absence of fellow-up data was an inevitable limitation of this study. Thirdly, disease duration and detailed medication histories (e.g., biologics, glucocorticoid dosages) were not documented in surgical records, limiting our ability to assess disease activity and management, and medication regimens may limit the generalizability of our findings. In future prospective work, we will collaborate with rheumatologists to obtain precise disease onset dates and medication histories, and integrate preoperative disease activity indices to better contextualize surgical outcomes. Fourthly, functional outcomes were assessed only at discharge; future studies should incorporate serial evaluations at standardized intervals (e.g., 1 week, 1 month) to better characterize recovery trajectories. Fifthly, while preoperative biomarker baselines were comparable, the retrospective design precluded analysis of individual patient trajectories. Future prospective studies should integrate serial measurements to dissect surgery-specific effects within each disease cohort. Sixthly, while preoperative DVT was excluded via ultrasound, the retrospective design limited our ability to analyze whether higher Caprini scores in RA patients correlated with specific thrombogenic mechanisms (e.g., hypercoagulability markers). Prospective studies should integrate both risk scores and biomarker profiling. Overall, more studies to further clarifying the conclusion of this study should be carried out in future.

Conclusion

In summary, in this study, we found that AS patients underwent increased operative blood loss during THA and increased autologous transfusion rate as compared with the RA patients. In addition, we found that RA patients showed increased serum level of some inflammatory indicators, including ESR and IL-6, while no significant difference was found between the two groups in terms of perioperative complications. According to the founding of this study, we suggested that more attention should be paid to the blood loss management of AS patients during perioperative stage.

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Author contributions

Y Hu and T Lei conceived the original ideas of this study. H Chen and J Nan collected and analyzed patients' information and experimental data. Y Hu, T Lei, H Chen and J Nan discussed the controversial parts during the process of data acquisition and statistical analysis. H Chen and J Nan wrote the main manuscript text and H Qian prepared Tables 1, 2, 3 and 4 and the manuscript was finished under the supervision of Y Hu and T Lei. All authors have read and approved the manuscript.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
The study was approved by the Ethics committee of Xiangya hospital (proof number: 202008109) in accordance with the Declaration of Helsinki. A comprehensive agreement for academic use of information collected above was obtained from the patients by our hospital at the time of their hospitalization. No identifiable information of the participants is included in this paper.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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