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ORIGINAL ARTICLE

Total Hip Arthroplasty Revision: Causes and Changes Over the Past Two Decades?

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Abstract

Background: The revision of total hip arthroplasty (THA) is more challenging and has less successful outcomes than primary THA. Revision surgery takes more time, results in more blood loss, and has higher complication risks compared to primary surgery. Common reasons for revision include painful component loosening, implant failure, dislocations, infections, and periprosthetic fractures. Advances in surgical methods, implant designs, and bone loss management have assisted surgeons in addressing the challenges of revision THA and improving outcomes for patients undergoing this complex procedure.

Methods: In this retrospective cohort study, the THA revision surgeries of two groups conducted two decades apart were evaluated. All patient data, including age, gender, date of primary THA, date of revision surgery, reason for revision, and detailed intraoperative findings were recorded.

Results: The demographics were similar in both groups, but the average age was statistically significantly different ($p<0.001$). In the first group, it was 55.4 years, while in the second group, it was 63.5 years. The most common reason for revision in both groups was aseptic loosening. Infection, dislocation, and periprosthetic fractures were other reasons for revision.

Conclusion: The data indicate that dislocations have constituted a decreasing proportion of revision causes over time, likely attributable to improvements in surgical techniques, advancements in implant design, and the utilization of constrained liners. Nonetheless, infection persists as a significant challenge.

Keywords: Revision Surgery, Total Hip Arthroplasty, Prosthesis Loosening.

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INTRODUCTION

Total hip arthroplasty (THA) is one of the most successful and commonly performed orthopaedic procedures, with over 1 million procedures performed worldwide each year (1). A 2019 study estimated that over 2.5 million primary and revision THAs were performed globally in 2018 and predicted a continuous growth to 5.7 million procedures by 2050 (2).

Examinations of preserved skeletons have revealed that osteoarthritis and rheumatic diseases have affected people since ancient times. Surgical procedures to restore hip joint mobility have origins in treating these debilitating conditions (3). In 1891, with Themistocle Glück, articular replacement operations involving the acetabulum and the femur began (4). Prosthesis developed by Müller and later Charnley's "Low friction arthroplasty" definition laid the foundations of today's THA knowledge and technique (5). On the other hand, revision surgery has followed a parallel course to THA since its inception. Then, THA has continued to evolve, and revision procedures have become integral to addressing complex issues following the index surgery (6).

THA revision is more challenging and has less successful outcomes than primary THA. Revision surgery means longer operative times, greater blood loss, and higher complication rates (7-9). Understanding the etiology of this challenging treatment will guide the treatment in the right direction. Changes in patient demographics, advances in implant design, surgical techniques, and postoperative care may all contribute to shifting trends in revision indications (10).

This study aims to analyze the primary causes of THA revision and how they have changed over the last 20 years, providing insights that may guide future clinical practice and healthcare planning.

MATERIALS AND METHODS

This study retrospectively evaluated the THA revision surgeries performed between September 12, 1989, and September 8, 1999, and from December 10, 2014, to December 11, 2018, at the 1st Orthopaedics and Traumatology Clinic of SBÜ Dışkapı Yıldırım Beyazıt Training and Research Hospital, formerly known as the SSK Ankara Training Hospital. This study was approved by Ankara Etlik City Hospital local ethics committee (Date: 12.03.2025 No: AEŞH-BADEK-2025-243). The research protocol adhered to the principles of the Helsinki Declaration.

In the planning phase of this study, two patient cohorts that were closely matched in terms of sample size and spanned an approximately 20-year interval between the periods of surgical intervention were intended. Patients were selected sequentially, and all patients whose radiographs and records were accessible were included in the study. Comparing these two cohorts provides valuable insights into the evolving patterns of THA revisions, changes in patient demographics, and improvements in surgical techniques and implant technology over the past two decades. Patients who did not have a THA before revision surgery, did not have sufficient data or imaging of poor quality and did not want to participate in the study were not included in the study. In patients with multiple reasons for revision, the primary problem was considered the reason for revision.

All patient data, including age, gender, date of primary THA, date of THA revision, reason for revision, and detailed intraoperative findings, were recorded. During the first 10-year period, 180 revision surgeries were performed on 144 patients by multiple different surgeons in a training hospital setting. Since our study focused exclusively on the reasons for revision following THA, in the first group, 143 revisions were performed on 112 patients, 69 female and 43 male, after THA. The other index operations included 18 endoprostheses, seven bipolar hemiarthroplasties, six Girdlestone operations for unknown reasons, and one revision based on cup arthroplasty.

A total of 127 revision surgeries were conducted during the second four-year period. Of these, 111 revision surgeries were performed following primary THA, involving a total of 82 patients. However, 3 patients were excluded due to lack of consent, and an additional 13 patients were omitted from the analysis as their index surgeries were not THA.

Statistical Analysis

All data were analyzed using IBM® SPSS for Windows version 22. The Kolmogorov-Smirnov test was employed to assess the normality of continuous variables.

The selection of statistical tests depended on the distribution of the data. For variables distribute normally, T test was used. For variables that did not follow a normal distribution, non-parametric tests, such as the Mann-Whitney U test, were utilized for comparisons. The Chi-square test was used to evaluate associations between categorical variables across groups. Categorical variables were described using frequency distributions, including numbers and percentages. Continuous variables were characterized by measures of central tendency, such as the mean, median, and mode, alongside measures of dispersion, like the standard deviation, interquartile range, and minimum-maximum values. A significance level of $p \leq 0.05$ was adopted to determine statistical significance.

RESULTS

In the first 10-year period, 180 THA revision procedures were conducted, while in the subsequent four-year period, the number of revision procedures decreased to 111.

The mean age of the patients in the first group at the time of surgery was 55.4 years, with the youngest being 24 and the oldest 80 years old (Figure 1). Sixty-nine of our patients were female, and 43 were male (Figure 2). Looking at our patients in general, 17 patients had two previous surgeries, one had three surgeries, and three had more than three surgeries before the revision surgery. The reasons for revision were loosening in 62 cases, dislocations in 38 cases, infections in 15 cases, fractures in 14 cases, and other reasons in 14 cases (Figure 3).

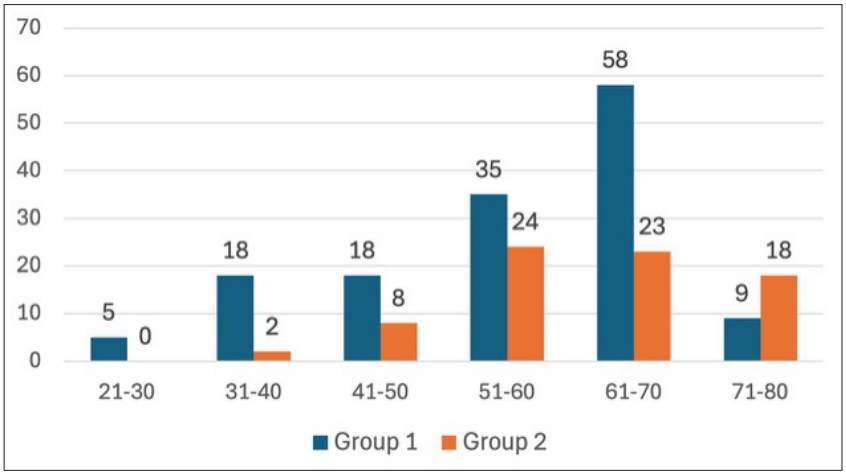

Figure 1: Distribution of patients' age according to groups at the time of revision surgery

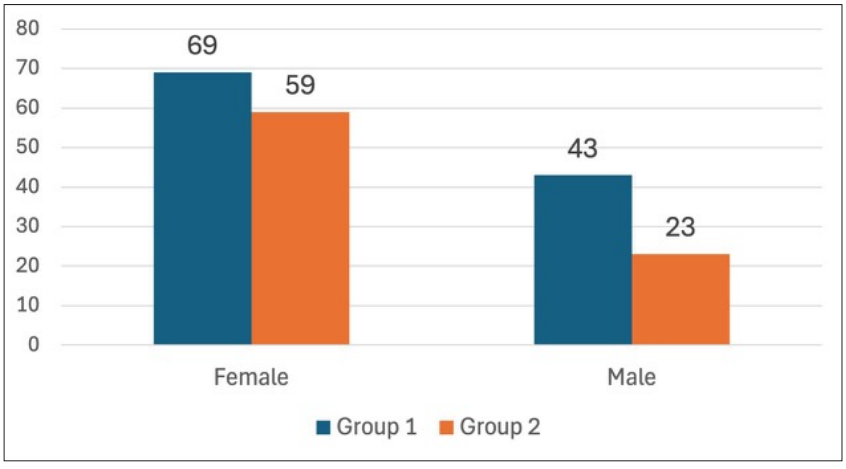

Figure 2: Distribution of patients' gender according to groups

In the second group, the mean age of the patients at the time of surgery was 63.5 years, with the youngest being 35 and the oldest 89 years old (Figure 1). Fifty-nine of our patients were female, and 23 were male (Figure 2). Eight patients had two revisions, four had three revisions, and three had more than four revision surgeries. The reasons for the revisions were loosening in 76 cases, dislocations in 11 cases, infections in 19 cases, and fractures in 5 cases (Figure 3).

The analysis reveals a significant difference in the age distribution between the two patient groups, with the second group being notably older on average ($p<0.001$). However, no substantial difference was observed in the gender distribution across the cohorts. ($p=0.133$) Also the analysis reveals a notable shift in the primary reasons for revision surgery between the two patient cohorts. While aseptic loosening remained the leading cause in both groups, its prevalence significantly increased in the second group. Conversely, the proportion of revisions due to dislocation and periprosthetic fracture decreased over time. Despite the observed changes, the overall distribution of revision indications did not exhibit statistically significant differences between the two study periods ($p<0.001$) (Table 1).

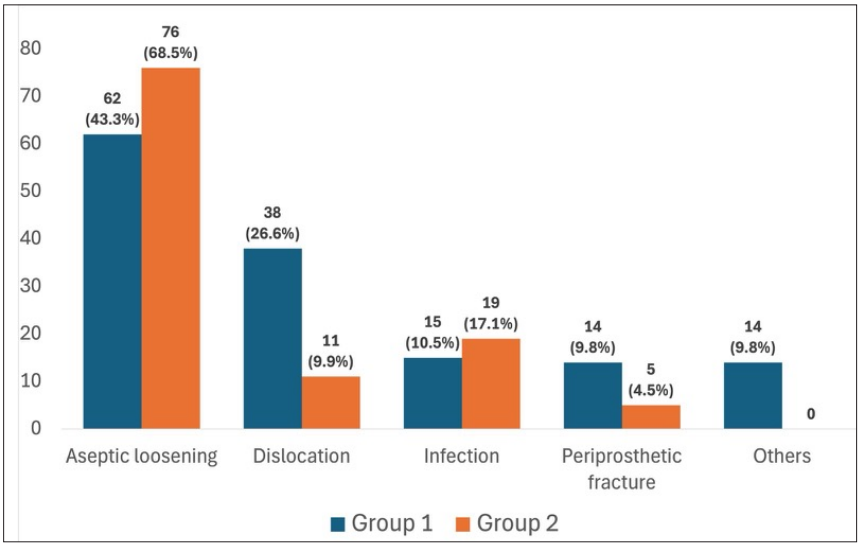

Figure 3: Distribution of causes of revision surgery according to groups

The most frequent procedure in both groups is the revision of both components, followed by the acetabular revision alone. The Girdlestone procedure (11) was performed in 10 cases in Group 1 but not in Group 2. Instead, an antibiotic spacer was preferred for a two-stage revision for infection (Table 2).

DISCUSSION

One of the most significant findings of this study is the age distribution of the patient groups. The first group had a mean age of 55.4 years, ranging from 24 to 80, with a concentration in the 61-70 age range. In contrast, the second group was older, with a mean age of 63.5 years and ages spanning 35 to 89, concentrated between 51-80 years old. This age difference can be attributed to the hospital being the final referral center for Social Security System patients before 2004 and known for extensively treating young individuals with secondary osteoarthritis. Compared to the existing literature, both cohorts had a lower average age at revision, suggesting a historical inclination to perform primary THA at younger ages within our patient population (7, 12).

The most common reason for revision varies in different studies in the literature. In some studies, the most common cause was dislocation/instability, while in others, aseptic loosening was reported as the most common cause (12-14). In this study, aseptic loosening was observed as the most common reason for THA revision in both groups. However, a notable shift was observed

Table 1. Revision surgeries performed to patients according to groups

Surgical procedure	Number of operations, n (%)	
	Group 1	Group 2
Both components changed	59 (41.3)	39 (35.1)
Only the acetabular component changed	29 (20.2)	43 (38.7)
Girdlestone procedure	10 (7)	0
Only the femoral component changed	9 (6.3)	1 (0.9)
Open reduction	8 (5.6)	2 (1.8)
Open reduction and internal fixation	5 (3.4)	5 (4.5)
Debridement	2 (1.4)	6 (5.4)
Closed reduction	2 (1.4)	1 (0.9)
Grafting	2 (1.4)	0
Only the liner changed	0	1 (0.9)
Only the femoral head changed	1 (0.6)	0
Antibiotic spacer	0	12 (10.8)
Fistulectomy	1 (0.6)	1 (0.9)
Unknown	15 (10.4)	0
Total	**143**	**111**

in the frequency of other causes. While the order of revision causes remained broadly consistent, the proportional distribution changed over time. The declining rate of dislocation and instability related revisions highlights the positive impact of improved surgical techniques and implant design.

This decrease can be attributed to several key factors;

- Improved Surgical Techniques: Surgeons have gained experience in component positioning, leading to a lower incidence of postoperative instability (15-17).
- Enhanced Implant Design: The introduction of larger femoral heads and highly cross-linked polyethylene liners has significantly improved joint stability (18).
- Use of Constrained Liners: The incorporation of constrained liner systems in the 2000s has played a critical role in reducing dislocations by providing enhanced stability for high-risk patients (19).

Notably, component malpositioning is a leading cause of dislocations following hip arthroplasty and revision surgeries (8, 9). Periprosthetic joint infections (PJIs) remain among the most challenging complications following THA, often requiring multiple surgical interventions (20). While the infection rate in the second group was high at 17%, further analysis revealed that one patient underwent seven operations, and two patients had three revisions each. The infection rates between the two groups were comparable and aligned with the elevated infection rates reported in the literature for revision surgeries (21). The increased infection burden in the second group aligns with literature reports that revision THA is associated with higher infection rates than primary THA due to prolonged operative times, increased soft tissue trauma, and the presence of immunocompromised or elderly patients (21). The findings underscore the ongoing need for meticulous infection

prevention strategies, including prophylactic antibiotic regimens, improved sterile techniques, and optimized perioperative patient management.

Over the past two decades, significant advancements in THA materials and techniques have influenced revision surgery outcomes:

- Enhanced Implant Longevity: Modern implant materials, such as highly cross-linked polyethylene and improved metal alloys, have contributed to lower wear rates and increased implant durability, potentially reducing the need for revision due to aseptic loosening (22).
- Minimally Invasive Techniques: Adopting less invasive surgical approaches and refined soft tissue handling techniques have reduced postoperative complications and improved functional outcomes (23).
- Preoperative Planning with 3D Imaging and Navigation: The use of advanced imaging modalities, including 3D CT reconstructions and computer-assisted navigation, has enhanced preoperative planning, allowing for more precise component placement and better management of bone loss (24).
- Custom and Modular Implants: The development of modular and custom implants has enabled surgeons to address complex revision cases with greater adaptability, especially in cases with severe bone loss (25).

The most frequent revision procedure in this study was observed to be the replacement of both components similar to the previous literature (26). This may be due to aseptic loosening affecting both components in most patients or the inability to find compatible acetabular cup, liner or femoral stem with the previous components.

The Girdlestone procedure was observed to be used as a salvage method only in group 1. This shows that the need for salvage procedures is decreasing day by day. This is because revision surgeries can be performed instead of salvage procedures like Girdlestone procedure thanks to the newly designed implants.

The infection continues to pose a significant challenge in the revision of THA, necessitating ongoing research into preventive and treatment strategies. As THA procedures continue to increase worldwide, further refinements in surgical approaches, implant materials, and perioperative care will be critical in optimizing patient outcomes and minimizing the need for revision surgery.

Despite its valuable findings, this study has certain limitations. The most important limitation is the numerical differences between patient groups. Since the registration system used in our hospital is operated by different companies at certain intervals, the accessibility of the patient archive is limited. Also, the difference in data collection times between the two groups (10 years and 4 years) is another limitation of the study. In addition, revision total hip surgeries are performed less than in the past. The retrospective design inherently carries biases related to patient selection and data completeness. Additionally, the study is limited to a single institution, which may affect the generalizability of the results. Future research should focus on multi-center studies with larger sample sizes to validate these findings further. Additionally, long-term follow-up of contemporary THA cohorts is essential to assess the sustained impact of newer implant technologies and surgical techniques on revision rates.

The data indicate that dislocations have constituted a decreasing proportion of revision causes over time, likely attributable to improvements in surgical techniques, advancements in implant design, and the utilization of constrained liners. Nonetheless, infection persists as a significant challenge. Further prospective, multi-center studies, coupled with ongoing innovation in implant technologies and surgical protocols, are essential to mitigate the incidence of THA revisions and improve long-term patient outcomes.

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Abbreviations list

THA: Total hip arthroplasty
PJI: Periprosthetic joint infections
3D CT: 3 Dimensional Computed Tomography
SBÜ: Sağlık Bilimleri Üniversitesi
SSK : Sosyal Sigortalar Kurumu

Ethics approval and consent to participate

This study was approved by Ankara Etlik City Hospital local ethics committee (Date: 12.03.2025 No: AEŞH-BADEK-2025-243). The research protocol adhered to the principles of the Helsinki Declaration.

Consent for publication

It does not contain any personal data.

Availability of data and materials

Not available.

Competing interests

All of the authors had no conflict of interest.

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Authors' contributions

Idea/Concept and Design: ED and MÇ. Control/Supervision: BK and MÇ. Data Collection And/Or Processing: OYA and ED. Analysis And/Or Interpretation: ED and OYA. Literature Review: OYA and BK. Writing The Article: ED. Critical Review: MÇ. References And Fundings: ED and OYA . Materials: ED and OYA.

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