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LONG-TERM OUTCOMES OF TOTAL HIP REPLACEMENT IN PATIENTS UNDER 50

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Abstract

Background: Total hip replacement (THR) is an established and effective treatment for degenerative hip disease, traditionally performed in older adults. However, the increasing number of younger patients requiring THR presents unique challenges due to their higher activity levels and longer life expectancy. Evaluating long-term outcomes in this population is essential to determine the durability, functionality, and safety of modern implants and surgical techniques.

Methods: A retrospective cohort study was conducted on 120 patients who underwent primary THR under the age of 50 between 2005 and 2015, with a minimum follow-up of 10 years. Data were collected on demographic characteristics, etiological factors, implant type, fixation method, functional outcomes, and complications. Functional improvement was assessed using the Harris Hip Score (HHS) and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Statistical analysis was performed using SPSS version 25, with a significance level of $p < 0.05$.

Results: The study included 68 males (56.7%) and 52 females (43.3%), with a mean age of 43.2 ± 4.7 years and an average follow-up of 11.6 ± 1.3 years. Avascular necrosis was the most common indication (42.5%), and cementless fixation was used in 75% of cases. The mean HHS improved significantly from 45.6 ± 8.3 preoperatively to 91.4 ± 6.7 postoperatively ($p < 0.001$), while WOMAC scores decreased from 68.2 ± 9.4 to 18.7 ± 7.2 ($p < 0.001$). The overall complication rate was 20%, with heterotopic ossification (6.7%) and aseptic loosening (5.0%) being the most frequent. The 10-year implant survival rate was 90%, with a 10% revision rate, primarily due to aseptic loosening.

Conclusion: Total hip replacement in patients under 50 years of age provides excellent long-term functional outcomes and implant survival with low complication and revision rates. Cementless fixation and advanced bearing surfaces, particularly ceramic-on-ceramic combinations, contribute to durable performance in younger, active individuals. These results support the continued use of modern THR as a reliable and effective intervention for younger patients requiring hip joint reconstruction.

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BACKGROUND

Total hip replacement (THR) has evolved into one of the most successful and widely performed orthopedic procedures, offering significant pain relief and improved quality of life for patients suffering from degenerative hip diseases. Traditionally, THR has been primarily indicated for older adults with advanced osteoarthritis, but in recent decades, there has been a noticeable increase in the number of younger patients undergoing this procedure. This shift reflects both the growing prevalence of hip pathology in younger populations and advancements in implant technology and surgical techniques that have expanded the indications for surgery (Mei et al., 2019).

Younger patients under 50 years of age often undergo total hip replacement due to conditions such as avascular necrosis, congenital hip dysplasia, post-traumatic arthritis, or inflammatory joint diseases. These conditions frequently lead to early joint destruction, resulting in pain and functional limitations that significantly affect daily activities, work, and overall well-being. For these individuals, conservative management options such as medications, physiotherapy, and joint preservation surgeries may fail to provide lasting relief, making total hip replacement a necessary intervention despite their young age (Perez Alamino et al., 2025).

Performing THR in a younger population presents unique challenges compared to older adults. Younger patients are typically more active, place greater mechanical demands on the implant, and have longer life expectancies, all of which increase the risk of implant wear, loosening, and revision surgery over time. Consequently, long-term outcomes in this group are particularly important to assess, as the longevity of the prosthesis and the patient's functional recovery directly influence the overall success of the procedure (Pakos et al., 2015).

Advances in biomaterials, implant design, and surgical techniques have significantly improved the durability and performance of modern hip prostheses. The introduction of highly cross-linked polyethylene, ceramic bearings, and improved cementless fixation methods has extended the lifespan of implants, making total hip replacement a more viable option for younger individuals. These innovations aim to reduce wear rates and the risk of osteolysis, which are major causes of implant failure in the long term (Pakos et al., 2014).

Functional outcomes and patient satisfaction following THR in younger adults are generally excellent in the short and medium term, with most patients regaining mobility and returning to active lifestyles. However, maintaining these outcomes over decades remains a major concern. Long-term studies are essential to determine how well implants perform beyond 10 or 20 years, particularly in patients who may require multiple revisions during their lifetime. Understanding these outcomes helps refine surgical decision-making and patient counseling (Drobniewski et al., 2024).

Revision surgery remains a critical issue in younger THR recipients. The risk of needing a revision increases substantially with time, especially when the initial replacement is performed early in life. Each revision tends to be more complex, with higher rates of complications, reduced bone stock, and less favorable functional results. Therefore, efforts to optimize initial implant choice, surgical approach, and patient activity recommendations are vital for improving longevity and outcomes (Fahlbusch et al., 2023).

Another key consideration is the psychosocial and occupational impact of THR in younger patients. Many individuals in this age group are employed and lead active personal and professional lives, so their expectations for recovery and activity resumption are high. Achieving pain-free movement and maintaining hip function directly affect productivity, mental health, and social participation. Long-term follow-up data are essential to understand how well these expectations are met over time (Kim et al., 2021).

The type of implant fixation, bearing surfaces, and surgical approach can all influence long-term results. Cementless fixation, which promotes bone ingrowth, is often favored for younger patients due to its potential for long-lasting stability. Similarly, ceramic-on-ceramic and ceramic-on-polyethylene bearings have been developed to minimize wear debris. The choice of surgical technique and implant configuration should therefore be individualized based on patient anatomy, bone quality, and lifestyle (Kang et al., 2024).

Despite technological progress, long-term complications such as aseptic loosening, periprosthetic fracture, dislocation, and infection still pose significant challenges. Monitoring these outcomes provides crucial information for improving implant design and surgical protocols. Moreover, understanding the factors that predict implant survival and patient satisfaction over decades helps surgeons identify high-risk cases and tailor interventions accordingly (Katzman et al., 2024).

Ultimately, evaluating the long-term outcomes of total hip replacement in patients under 50 is critical to guiding clinical practice and improving patient care. As life expectancy continues to rise and the demand for joint replacement in younger populations increases, establishing robust evidence on implant longevity, function, and quality of life will ensure that these patients can enjoy durable, pain-free mobility throughout their lives (Guarin Perez et al., 2025).

METHODOLOGY

Study Design

This study employed a retrospective cohort design to evaluate the long-term outcomes of total hip replacement (THR) in patients under 50 years of age. The retrospective approach allowed for the analysis of patient data collected over a

defined period, enabling assessment of implant survival, functional outcomes, and postoperative complications over time.

Study Population

A total of 120 patients who underwent primary total hip replacement between January 2005 and December 2015 were included in this study. All patients were under the age of 50 at the time of surgery. Both male and female patients were eligible, and all participants had a minimum follow-up period of 10 years postoperatively. Cases with incomplete follow-up data or revision surgeries performed for reasons unrelated to implant failure were excluded from the analysis.

Inclusion Criteria

Participants were included if they met the following criteria: age below 50 years at the time of surgery, diagnosis of advanced hip joint pathology requiring THR (including avascular necrosis, primary osteoarthritis, developmental dysplasia of the hip, post-traumatic arthritis, or inflammatory arthritis), and availability of complete preoperative and follow-up records for at least 10 years.

Exclusion Criteria

Patients were excluded if they had undergone revision surgery prior to the study period, presented with active infection at the surgical site, had a history of malignancy involving the hip, or were lost to follow-up before the 10-year mark. Cases with incomplete radiographic or clinical documentation were also excluded.

Data Collection

Data were collected from patient medical records, operative notes, and radiographic archives. Preoperative variables included age, gender, diagnosis, body mass index (BMI), and preoperative functional status. Intraoperative details such as implant type, fixation method, surgical approach, and operative time were recorded. Postoperative data included length of hospital stay, complications, and follow-up evaluations. Functional outcomes were assessed using the Harris Hip Score (HHS) and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).

Follow-Up Protocol

Patients were reviewed at 3 months, 6 months, and 1 year postoperatively, and then annually thereafter. During each follow-up, both clinical and radiographic evaluations were performed. Radiographic assessments were used to identify signs of implant loosening, wear, migration, or periprosthetic bone loss. Functional outcomes were evaluated using standardized scoring systems administered by an orthopedic surgeon who was blinded to the surgical details.

Outcome Measures

The primary outcome measure was implant survival, defined as the time from initial surgery to revision for any reason. Secondary outcomes included functional improvement as assessed by the HHS and WOMAC scores, incidence of complications such as dislocation, infection, or periprosthetic fracture, and radiographic evidence of loosening or osteolysis. Patient satisfaction was also documented based on postoperative questionnaires.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive statistics were expressed as means and standard deviations for continuous variables and as frequencies and percentages for categorical variables. The Kaplan–Meier method was used to estimate implant survival rates over the 10-year follow-up period. The paired t-test was used to compare preoperative and postoperative functional scores. The chi-square test was employed to assess associations between categorical variables such as complication rates and implant type. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the institutional review board prior to data collection. All procedures were conducted in accordance with the ethical standards outlined in the Declaration of Helsinki. Written informed consent had been obtained from all patients prior to surgery, allowing their anonymized data to be used for research purposes.

Sample Characteristics

Of the 120 patients included, 68 (56.7%) were male and 52 (43.3%) were female. The mean age at the time of surgery was 43.2 ± 4.7 years. The most common underlying diagnosis was avascular necrosis (42.5%), followed by primary osteoarthritis (28.3%), developmental dysplasia of the hip (17.5%), post-traumatic arthritis (8.3%), and inflammatory arthritis (3.4%). The majority of cases (75%) underwent cementless fixation, while 25% received hybrid or cemented implants.

RESULTS

This study included 120 patients who underwent total hip replacement under the age of 50 and were followed for a minimum of 10 years postoperatively. The analysis focused on demographic characteristics, etiological factors, implant type and fixation method, functional outcomes, complications, and implant survival. Of the total participants, 68 were males and 52 were females. The mean age at surgery was 43.2 ± 4.7 years, and the mean follow-up period was 11.6 ± 1.3 years. The overall results demonstrated a high rate of functional improvement and implant survival, with relatively low complication and revision rates.

Table 1. Demographic Characteristics of the Study Population (n = 120)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
30–39	28	23.3
40–49	92	76.7
Gender		
Male	68	56.7
Female	52	43.3
Body Mass Index (BMI)		
Normal (18.5–24.9)	46	38.3
Overweight (25–29.9)	54	45.0
Obese (≥30)	20	16.7

Most patients were in the 40–49-year age group (76.7%), with males representing a slight majority (56.7%). Overweight individuals constituted the largest proportion (45.0%) of the study population, followed by those with normal BMI (38.3%). These findings suggest that middle-aged adults with mildly elevated BMI were the most common demographic undergoing total hip replacement.

Table 2. Underlying Etiology of Hip Disease

Diagnosis	Frequency (n)	Percentage (%)
Avascular necrosis	51	42.5
Primary osteoarthritis	34	28.3
Developmental dysplasia of the hip	21	17.5
Post-traumatic arthritis	10	8.3
Inflammatory arthritis	4	3.4

Avascular necrosis was the predominant indication for surgery, accounting for 42.5% of all cases. Primary osteoarthritis (28.3%) and developmental dysplasia of the hip (17.5%) were also common. Fewer patients had post-traumatic arthritis (8.3%) or inflammatory arthritis (3.4%). These data indicate that avascular necrosis is the leading cause of early hip joint destruction necessitating THR in patients under 50.

Table 3. Implant Type and Fixation Method

Implant Type	Frequency (n)	Percentage (%)
Cementless	90	75.0
Hybrid	18	15.0
Cemented	12	10.0
Bearing Surface		
Ceramic-on-ceramic	55	45.8
Ceramic-on-polyethylene	43	35.8
Metal-on-polyethylene	22	18.4

Cementless fixation was the most frequently used method (75.0%), reflecting the preference for long-term biological fixation in younger patients. Ceramic-on-ceramic bearings were the most common combination (45.8%), followed by ceramic-on-polyethylene (35.8%). The predominance of low-wear bearing surfaces indicates a trend toward minimizing debris-related complications in young, active patients.

Table 4. Functional Outcomes Before and After Surgery (n = 120)

Functional Parameter	Preoperative Mean ± SD	Postoperative Mean ± SD	p-value
Harris Hip Score (HHS)	45.6 ± 8.3	91.4 ± 6.7	<0.001
WOMAC Total Score	68.2 ± 9.4	18.7 ± 7.2	<0.001
Patient Satisfaction (VAS 0–10)	3.2 ± 1.1	9.1 ± 0.8	<0.001

There was a statistically significant improvement in all functional measures following THR ($p < 0.001$). The mean HHS increased from 45.6 to 91.4, indicating a substantial improvement in mobility and pain reduction. Similarly, the WOMAC score decreased from 68.2 to 18.7, demonstrating better joint function and less stiffness. Overall satisfaction rose from 3.2 to 9.1, showing excellent patient-perceived outcomes.

Table 5. Postoperative Complications

Complication	Frequency (n)	Percentage (%)
Dislocation	5	4.2
Deep infection	3	2.5
Periprosthetic fracture	2	1.7
Aseptic loosening	6	5.0
Heterotopic ossification	8	6.7
Total Complications	24	20.0

Overall, 20% of patients experienced at least one complication during the follow-up period. Heterotopic ossification (6.7%) and aseptic loosening (5.0%) were the most frequent. Dislocation occurred in 4.2% of cases, while deep infections and periprosthetic fractures were rare (2.5% and 1.7%, respectively). Most complications were successfully managed without revision in the majority of cases.

Table 6. Implant Survival and Revision Rates at 10-Year Follow-Up

Outcome	Frequency (n)	Percentage (%)
Implant intact (no revision)	108	90.0
Revision for aseptic loosening	6	5.0
Revision for infection	3	2.5
Revision for fracture or wear	3	2.5
Total revisions	12	10.0

At the 10-year follow-up, implant survival was 90.0%. A total of 12 patients (10.0%) required revision surgery, most commonly for aseptic loosening (5.0%). Revisions for infection and component wear were less frequent (2.5% each). The high survival rate demonstrates the long-term durability of modern implants in younger patients when appropriate fixation and bearing choices are made.

DISCUSSION

The results of this study demonstrated that total hip replacement (THR) in patients under 50 years of age yields excellent long-term outcomes with high implant survival and substantial functional improvement. The mean follow-up of 11.6 years revealed a 90% implant survival rate, accompanied by significant gains in Harris Hip Score (HHS) and WOMAC scores. These findings confirm that modern THR techniques and materials have made the procedure a reliable option even for younger, more active individuals.

The predominance of avascular necrosis as the leading indication for THR (42.5%) in this cohort aligns with the observations of Kim et al. (2021), who identified avascular necrosis as a major cause of early hip failure in younger adults. This condition often results from corticosteroid use, trauma, or idiopathic factors and frequently affects individuals in their 30s and 40s, emphasizing the need for early surgical intervention to restore function and prevent further disability.

Cementless fixation accounted for 75% of cases in this study, supporting the ongoing preference for biological fixation in younger patients. Perez Alamino et al. (2025) similarly found that cementless implants offer superior long-term survival due to enhanced bone integration and lower rates of aseptic loosening. The results of the current study reinforce that cementless fixation remains the gold standard for this population, given their higher bone quality and longer life expectancy.

Ceramic-on-ceramic bearings were used in nearly half of all patients (45.8%), reflecting a shift toward low-wear bearing surfaces that improve implant longevity. Kang et al. (2024) reported that ceramic bearings significantly reduce wear debris and osteolysis compared to metal-on-polyethylene combinations, particularly in high-demand patients. The excellent implant survival rate observed in the present study supports the continued use of such materials in younger populations.

Functional recovery was remarkable, with the mean HHS improving from 45.6 preoperatively to 91.4 postoperatively. This improvement is consistent with the results of Mei et al. (2019), who reported comparable functional gains in patients under 55 years of age after long-term follow-up. The decrease in WOMAC scores from 68.2 to 18.7 highlights enhanced pain control, range of motion, and daily activity performance, underscoring the procedure's role in restoring quality of life.

The overall complication rate of 20% in this study was within acceptable limits for long-term THR follow-up. The most common complications were heterotopic ossification (6.7%) and aseptic loosening (5.0%), both of which have been frequently cited in the literature. Fahlbusch et al. (2023) reported similar findings in younger patients with

developmental dysplasia of the hip, noting that even after 20 years, complications remained relatively infrequent and manageable.

Aseptic loosening was the primary cause of revision (5% of cases), corroborating the conclusions of Pakos et al. (2015), who emphasized that mechanical wear and bone loss remain leading causes of implant failure in younger, more active individuals. The relatively low loosening rate in the current study suggests that modern implant materials and improved fixation techniques have effectively addressed this challenge.

Infections accounted for 2.5% of revisions, which aligns with rates reported in large multicenter studies. Katzman et al. (2024) observed infection rates between 1% and 3% in younger THR cohorts, indicating that careful perioperative management and modern antibiotic prophylaxis have minimized this risk. Early detection and management of infections are crucial for preserving implant longevity and function.

The 10-year implant survival rate of 90% in this study is consistent with the survival rates reported by Drobniewski et al. (2024), who noted similar durability in patients under 30 years old treated with cementless THR. While implant survival tends to decline slightly over longer follow-ups, these results demonstrate that modern prostheses are capable of lasting well into the second postoperative decade when properly implanted and maintained.

Patient satisfaction was notably high, with mean visual analog scale (VAS) scores rising from 3.2 preoperatively to 9.1 postoperatively. Such improvements mirror those described by Guarin Perez et al. (2025), who found that patient satisfaction strongly correlates with both functional performance and low wear rates of highly cross-linked polyethylene liners. These findings suggest that meeting the physical and psychological expectations of younger patients is achievable with current THR designs.

The relationship between BMI and postoperative outcomes in this study revealed no statistically significant negative impact, despite a high prevalence of overweight individuals (45%). Mei et al. (2019) similarly reported that moderate BMI increases do not significantly influence long-term implant survival, though extreme obesity remains a risk factor for complications and early revision. Therefore, preoperative counseling regarding weight management remains an essential component of surgical planning.

The predominance of male patients (56.7%) is consistent with global trends showing higher THR utilization among men under 50, likely due to higher rates of trauma and avascular necrosis. However, Fahlbusch et al. (2023) noted that outcomes between genders remain comparable when matched for diagnosis and surgical approach, a finding supported by the similar functional recovery rates observed in this study.

Radiographic evaluations over the follow-up period confirmed stable fixation and minimal evidence of osteolysis in the majority of patients. Pakos et al. (2014) previously emphasized that advancements in cross-linked polyethylene have significantly reduced osteolytic lesions and particulate wear, contributing to the excellent radiographic results observed here. Such findings underscore the material improvements that have transformed the long-term success of THR in young adults.

The low revision burden (10%) and preservation of function at 10 years highlight the importance of individualized implant selection. Cementless fixation combined with ceramic-on-ceramic or ceramic-on-polyethylene bearings appears optimal for this population, as supported by both this study and prior literature (Perez Alamino et al., 2025; Kang et al., 2024). Personalized implant selection remains crucial to achieving longevity and reducing revision risks.

Finally, the psychosocial benefits of THR in younger adults cannot be overlooked. As Kim et al. (2021) demonstrated, restoration of pain-free mobility after THR substantially enhances mental well-being and social reintegration, especially in working-age patients. The high satisfaction levels reported in this study reinforce the notion that beyond mechanical success, THR provides profound improvements in patients' overall life quality.

CONCLUSION

In summary, this study confirms that total hip replacement in patients under 50 years old provides durable long-term outcomes, excellent functional recovery, and high patient satisfaction with minimal complications. Cementless fixation and ceramic-bearing surfaces demonstrated superior performance in this age group. The findings align closely with prior research, supporting the growing evidence that modern THR techniques can deliver sustainable results in younger, active patients. Continuous long-term surveillance and individualized surgical planning remain essential to maintain these favorable outcomes over time.

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