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The Short-Term Complications Following Primary Total Hip Arthroplasty: A Retrospective Cohort Analysis in Iran

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Abstract

Background: Total hip arthroplasty (THA) is a highly effective yet resource-intensive procedure. Understanding local epidemiology of short-term complications is crucial for optimizing outcomes, especially in diverse populations where data may be limited.

Objective: This study investigates the incidence and demographic associations of key short-term complications following primary THA in an Iranian tertiary referral center.

Methods: A retrospective cohort study was conducted on 92 consecutive patients who underwent primary THA at a major academic hospital in Tehran, Iran, between March 2019 and May 2024. The surgical approach was recorded, with the direct lateral approach being the most commonly used. Patient demographics, body mass index (BMI), surgical indication, and postoperative complications, specifically surgical site infection (SSI), prosthetic dislocation, venous thromboembolism (VTE), and leg length discrepancy (LLD), were extracted from medical records. Statistical analysis was performed using SPSS v22, with significance set at $p<0.05$.

Results: The mean age was 49.2 ± 15.2 years, and the mean BMI was 25.6 ± 4.3 kg/m². Osteoarthritis (50.0%) was the most common indication. Regarding surgical approach, 24 patients (26.8%) underwent THA via an anterior approach, while 68 patients (73.2%) underwent THA via a direct lateral approach. The incidence of complications was: SSI 3.3% (n=3), dislocation 5.4% (n=5), and VTE 1.1% (n=1). All SSI cases occurred in male patients. Dislocation rates were numerically higher in patients under 50 years (8.0% vs. 2.4%, p=0.37) and in females (9.3% vs. 2.0%, p=0.17). The single VTE case occurred in an obese (BMI>30) female. No statistically significant association was found between BMI categories and complication rates. Mean LLD was 9.7 ± 5.7 mm, with no significant variation across demographic groups.

Conclusion: In this small cohort, SSI and VTE rates were within internationally reported ranges. The dislocation rate (5.4%) was elevated despite the predominant use of the direct lateral approach, suggesting that factors beyond surgical approach, such as implant selection or patient-specific variables, may contribute to instability in this population. Larger, multicenter studies are needed to determine complication rates and risk factors accurately.

Keywords: Total hip arthroplasty, Short-term complications, Dislocation, Surgical site infection, Venous thromboembolism.

1. Background

Total hip arthroplasty (THA) stands as a transformative intervention for end-stage hip pathology, offering profound improvements in pain, function, and quality of life (1, 2). The escalating global demand for this procedure, driven by aging populations and rising prevalence of degenerative joint disease, underscores its pivotal role in contemporary musculoskeletal care (3). However, the undeniable success of THA is tempered by its associated risks. Short-term complications, most notably surgical site infection (SSI), prosthetic dislocation, venous thromboembolism (VTE), and symptomatic leg length discrepancy (LLD), represent critical challenges in the

postoperative period (4-8)

These complications carry substantial clinical and socioeconomic consequences. A periprosthetic joint infection (PJI) is a catastrophic event, often necessitating multiple revision surgeries, prolonged antibiotic therapy, and resulting in inferior functional outcomes and exorbitant costs, which can exceed four times that of the index procedure (9, 10). Prosthetic dislocation, a leading cause of early revision, not only causes significant patient distress but also imposes a major burden on healthcare systems through emergency visits, readmissions, and reoperations (11). VTE remains a potentially fatal complication, and despite advances in chemoprophylaxis, it continues to be a leading cause of morbidity and mortality following major orthopedic surgery (12). Even LLD, while often considered a minor issue, is a frequent source of patient dissatisfaction, gait abnormalities, and persistent pain, and is a common cause of litigation in orthopedic practice (13).

The imperative to study these complications extends beyond mere documentation of incidence. In an era emphasizing value-based healthcare and personalized medicine, understanding the local epidemiology and associated risk factors is fundamental to improving patient safety and optimizing resource allocation. While robust data from Western registries have shaped international guidelines (14, 15), their direct applicability to diverse populations, such as in the Middle East, may be limited. Regional variations in genetic predisposition, body habitus (e.g., higher prevalence of obesity), comorbidity profiles (e.g., diabetes mellitus), cultural factors affecting rehabilitation, and differences in healthcare delivery systems can significantly influence surgical outcomes (16, 17). A precise, population-specific risk assessment is therefore not an academic exercise but a clinical necessity. It enables surgeons to provide more informed preoperative counseling, tailor surgical planning (e.g., implant selection and approach), and implement targeted perioperative protocols for high-risk subgroups.

In Iran, despite a growing volume of THA procedures (18), comprehensive national data on short-term complications remain scarce. Most existing studies are single-center, focus on long-term survivorship, or examine isolated complications. It leaves a significant knowledge gap regarding the holistic profile and demographic correlates of early postoperative morbidity in the Iranian patient population. Addressing this gap is crucial for developing evidence-based, locally relevant quality improvement initiatives.

Therefore, this study was conducted to determine the incidence of major short-term complications following primary THA at a high-volume tertiary center in Tehran, Iran, and to analyze their association with fundamental demographic variables: age, sex, and body mass index (BMI). By elucidating the local complication landscape and identifying potential demographic risk patterns, this research aims to provide a foundation for refining clinical practice, enhancing patient safety, and ultimately improving the standard of care for patients undergoing THA in our setting.

2. Objective

This study investigates the incidence and demographic associations of key short-term complications following primary THA in an Iranian tertiary referral center.

3. Methods

3.1. Study Design and Setting

A retrospective historical cohort study was conducted at Firoozgar Hospital, a tertiary referral center in Tehran, Iran. The institutional ethics committee approved the

study protocol and waived informed consent due to the study's retrospective nature.

3.2. Study Population and Eligibility Criteria

The target population comprised all patients who underwent primary total hip arthroplasty (THA) at the study center between March 2019 and May 2024.

Inclusion Criteria:

1. Age >18 years.
2. Undergone primary, elective THA.
3. Received standard pharmacological thromboprophylaxis during hospitalization.
4. Availability of a complete medical record, including surgical reports, laboratory results, and imaging studies.

Exclusion Criteria:

1. History of previous hip surgery on the ipsilateral side.
2. Concurrent major surgery on the lower limbs during the same admission.
3. Incomplete medical records or missing essential data (e.g., complication status, demographic information).

A census sampling method was employed, and all eligible patients within the specified timeframe were included, resulting in a final cohort of 92 patients.

3.3. Data Collection and Study Variables

Data were extracted from hospital archives and electronic medical records using a structured, researcher-designed checklist.

Independent Variables:

Demographic data: age, sex, height, weight, and calculated Body Mass Index (BMI). Surgical data: the surgical approach (posterior, direct lateral, or anterior) was recorded from operative notes. Due to the study's retrospective design and variation in surgeon preferences, implant-specific details, such as femoral head size and liner type, were not consistently available for analysis.

Primary Outcome Variables (Short-term Complications):

Complications were assessed within a 12-month postoperative period and defined as follows:

1. ***Surgical Site Infection (SSI):*** Diagnosed according to the Centers for Disease Control and Prevention (CDC) criteria, categorized as superficial, deep, or organ/space infection.

2. **Prosthetic Dislocation:** Defined as the radiographic evidence of separation of the femoral head from the acetabular liner.

3. **Venous Thromboembolism (VTE):** Included Deep Vein Thrombosis (DVT), confirmed by venous Doppler ultrasound, or Pulmonary Embolism (PE), diagnosed via computed tomography pulmonary angiography or high clinical suspicion with positive D-dimer.

4. **Leg Length Discrepancy (LLD):** Measured in millimeters on standardized postoperative anteroposterior pelvic radiographs. Measurements were performed by a hip surgery fellow under the supervision of a musculoskeletal radiologist. A discrepancy of ≥10 mm was considered clinically significant.

3.4. Statistical Analysis

Data were analyzed using IBM SPSS Statistics software (Version 22.0). Continuous variables were described using mean and standard deviation (SD), while

categorical variables were presented as frequency and percentage (%). The association between categorical demographic variables and the occurrence of complications was analyzed using the Chi-square test or Fisher's exact test, as appropriate. To compare continuous variables (e.g., LLD) between groups, the independent t-test or the Mann-Whitney U test was used. Analysis of variance (ANOVA) was used to compare more than two groups. A p-value of less than 0.05 was considered statistically significant. To better quantify the risk of Type II errors (false negatives) given our modest sample size, a post hoc power analysis was conducted for the key comparisons of dislocation rates across age and sex groups using G*Power.

4. Results

4.1. Baseline Demographic and Clinical Characteristics

A total of 92 patients who underwent primary total hip arthroplasty were included in this retrospective cohort analysis. The mean age of the cohort was 49.2 ± 15.2 years (range: 16–77). The mean body mass index (BMI) was 25.6 ± 4.3 kg/m², indicating that the average patient was at the threshold of the overweight category. Regarding surgical approach, 24 patients (26.8%) underwent THA via an anterior approach, while 68 patients (73.2%) underwent THA via a direct lateral approach. No cases utilized the direct anterior approach during the study period. The most common surgical indication was degenerative joint disease (osteoarthritis), accounting for 50% of cases (n=46), followed by femoral neck fracture (31.5%, n=29) and avascular necrosis of the femoral head (18.5%, n=17). The mean leg length discrepancy (LLD) for the entire cohort was 9.7 ± 5.7 mm. The baseline characteristics of the study population are presented in Table 1.

Table 1. Baseline demographic and clinical characteristics of patients undergoing primary total hip arthroplasty (N=92)

Characteristic	Value
Age, years	
Mean ± SD	49.2 ± 15.2
Sex, n (%)	
Male	49 (53.3)
BMI, kg/m²	
Mean ± SD	25.6 ± 4.3
BMI Category, n (%)	
Normal (18.5–24.9)	43 (46.7)
Overweight (25–29.9)	39 (42.4)
Obese (≥30)	10 (10.9)
Surgical approach, n (%)	
Anterior	24 (26.1)
Direct Lateral	68 (73.9)
Surgical Indication, n (%)	
Osteoarthritis	46 (50.0)
Femoral Neck Fracture	29 (31.5)
Avascular Necrosis	17 (18.5)
Leg Length Discrepancy, mm	
Mean ± SD	9.7 ± 5.7

4.2. Incidence of Short-Term Complications

The overall incidence of short-term complications within the first postoperative year was as follows: surgical site infection (SSI) occurred in 3 patients (3.3%), prosthetic dislocation in 5 patients (5.4%), and venous thromboembolism (VTE) in 1 patient (1.1%). The distribution of complications is

summarized in Table 2.

Table 2. Incidence of short-term complications following primary total hip arthroplasty

Complication	N (%)	95% CI
Surgical Site Infection (SSI)	3 (3.3)	0.006–9.2
Prosthetic Dislocation	5 (5.4)	1.8–12.2
Venous Thromboembolism (VTE)	1 (1.1)	0.003–5.9
Any Complication*	9 (9.8)	4.6–17.8

*Some patients experienced multiple complications

4.3. Association of Complications with Demographic Factors

4.3.1. Body Mass Index (BMI)

When BMI categorized patients into normal weight (20–25 kg/m²), overweight (25–30 kg/m²), and obese (>30 kg/m²) groups, the dislocation rate was numerically higher in the overweight (7.7%) and obese (10.0%) groups compared to the normal weight group (2.3%). The single case of VTE occurred in the obese group. However, no statistically significant association was found between BMI categories and the incidence of any complication ($p > 0.05$ for all). The mean LLD also did not differ significantly across BMI categories ($p = 0.458$). Data are detailed in Table 3.

Table 3. Association between BMI categories and postoperative complications

Variable	Normal weight (n=43)	Overweight (n=39)	Obese (n=10)	P
SSI, n (%)	2 (4.7)	1 (2.6)	0 (0.0)	0.721†
Dislocation, n (%)	1 (2.3)	3 (7.7)	1 (10.0)	0.620†
VTE, n (%)	0 (0.0)	0 (0.0)	1 (10.0)	0.188†
LLD, mm (Mean ± SD)	9.26 ± 6.24	9.87 ± 5.51	12.10 ± 4.43	0.458‡
Variable	<50 years (n=50)	≥50 years (n=42)		
SSI, n (%)	2 (4.0)	1 (2.4)		0.999†
Dislocation, n (%)	4 (8.0)	1 (2.4)		0.374†
VTE, n (%)	1 (2.0)	0 (0.0)		0.999†
LLD, mm (Mean ± SD)	10.08 ± 5.93	9.29 ± 5.46		0.509‡
Variable	Female (n=43)	Male (n=49)		P
SSI, n (%)	0 (0.0)	3 (6.1)		0.246†
Dislocation, n (%)	4 (9.3)	1 (2.0)		0.181†
VTE, n (%)	1 (2.3)	0 (0.0)		0.463†
LLD, mm (Mean ± SD)	10.37 ± 5.15	9.14 ± 6.14		0.307‡

†Fisher's exact test; ‡One-way ANOVA

4.3.2. Age

Stratifying patients by age (<50 years vs. 50 years or older) showed a numerically higher dislocation rate in the younger group (8.0% vs. 2.4%, $p = 0.37$). A post hoc analysis revealed that, given the sample size and the observed effect size, the statistical power to detect this difference as significant was only 24%. No significant age-related differences were observed for the incidence of SSI or VTE ($p > 0.05$). The mean LLD was similar between the two age groups (10.08 ± 5.93 mm vs. 9.29 ± 5.46 mm, $p = 0.509$). These findings are presented in Table 4.

Table 4. Association between age groups and postoperative complications

Variable	<50 years (n=50)	≥50 years (n=42)	P
SSI, n (%)	2 (4.0)	1 (2.4)	0.999†
Dislocation, n (%)	4 (8.0)	1 (2.4)	0.374†
VTE, n (%)	1 (2.0)	0 (0.0)	0.999†
LLD, mm (Mean ± SD)	10.08 ± 5.93	9.29 ± 5.46	0.509‡

†Fisher's exact test; ‡Independent t-test

4.3.3. Sex

The cohort consisted of 49 (53.3%) male and 43 (46.7%) female patients. All cases of SSI (n=3) occurred in male patients (6.1% of males vs. 0% of females, p = 0.243). In contrast, dislocation was more frequently observed in female patients (9.3% vs. 2.0% in males, p = 0.174), with a post-hoc power of 32% for this comparison, and the single VTE case occurred in a female patient. These sex-based differences did not reach statistical significance. The mean LLD was comparable between males and females (10.37 ± 5.15 mm in females vs. 9.14 ± 6.14 mm in males, p = 0.307). The associations between sex and complications are shown in Table 5.

Table 5.Association between sex and postoperative complications

Variable	Female (n=43)	Male (n=49)	P
SSI, n (%)	0 (0.0)	3 (6.1)	0.246†
Dislocation, n (%)	4 (9.3)	1 (2.0)	0.181†
VTE, n (%)	1 (2.3)	0 (0.0)	0.463†
LLD, mm (Mean ± SD)	10.37 ± 5.15	9.14 ± 6.14	0.307‡

†Fisher's exact test; ‡Independent t-test

5. Discussion

This retrospective cohort study describes the incidence of short-term complications following primary total hip arthroplasty (THA) in a tertiary care center in Tehran. In this cohort of 92 patients, the observed rates were: surgical site infection (SSI) 3.3%, prosthetic dislocation 5.4%, and venous thromboembolism (VTE) 1.1%. Dislocation was observed in 4 of 50 patients (8.0%) aged 50 years or younger, compared with 1 of 42 patients (2.4%) aged 50 years or older, and in 4 of 43 female patients (9.3%) compared with 1 of 49 male patients (2.0%). All three SSI cases occurred in male patients. The direct lateral approach, associated with greater inherent stability, was used in the majority of cases (73.9%), making the observed 5.4% dislocation rate particularly noteworthy.

5.1. Analysis of Short-Term Complications

5.1.1. Surgical Site Infection (SSI)

The SSI rate of 3.3% in our cohort aligns with the upper limit of the 0.6–3% range reported in large-scale reviews for primary THA (14). This rate, while within the reported global spectrum, is numerically higher than the sub-1% rates achieved by centers implementing stringent, multi-modal infection prevention bundles (19). These bundles typically include optimized prophylactic antibiotic regimens, rigorous glycemic control, advanced skin antisepsis, and strict operating room environmental controls. The observed rate may reflect variations in local implementation of such protocols, hospital infrastructure, or specific epidemiological characteristics of our patient population, such as a higher prevalence of comorbidities (20). A notable finding was that all SSI cases occurred in male patients, although this association was not statistically significant. While large registry studies have not consistently identified male sex as an independent risk factor for SSI (21), this observation warrants further investigation. Potential contributing factors in our setting could include higher rates of modifiable risk behaviors (e.g., smoking), differences in postoperative wound care compliance, or underlying biological variations in immune response (22, 23).

5.1.2. Prosthetic Dislocation

The dislocation rate of 5.4% is notably higher than the commonly cited range of

0.2–1.7% for primary THA in the international literature (11, 24). This finding is particularly noteworthy given that the direct lateral approach, which preserves the posterior soft tissues and is associated with greater inherent stability, was used in 73.9% of cases in this cohort (25). The anterior approach, typically associated with higher dislocation rates, was used in only 26.1% of patients. Several factors may explain this elevated dislocation rate despite the predominance of a stable surgical approach. First, implant-related factors likely played a role, as standard practice at our center during the study period involved the use of smaller-diameter femoral heads (28 mm or 32 mm) and standard polyethylene liners, while larger femoral heads (≥36 mm) and dual-mobility constructs, which have been shown to reduce dislocation risk significantly, were not routinely used. Second, patient-specific anatomy may have contributed, as the observation that 4 of 5 dislocations (80%) occurred in female patients raises the possibility that anatomical factors such as smaller acetabular dimensions or reduced femoral offset may have increased instability; achieving optimal component positioning and soft-tissue tension can indeed be more challenging in female anatomy (26, 27). Third, while the surgical approach itself was documented, the nuances of surgical technique, including the integrity of the abductor mechanism repair in the lateral approach, could not be assessed retrospectively. Fourth, data on surgeon volume and experience were unavailable, though these factors are known to influence outcomes. Collectively, the finding that dislocation occurred at a relatively high rate despite the predominant use of a stable approach suggests that implant selection and patient-specific factors may be at least as important as surgical approach in determining stability in our population.

Our data shows a clinical trend, with dislocation rates numerically higher in patients under 50 years (8.0% vs. 2.4%) and in female patients (9.3% vs. 2.0%). These trends are biologically plausible. Younger, more active patients may subject the prosthesis to greater and more complex mechanical forces (24). Anatomical differences in the female pelvis, including a smaller acetabulum and distinct bony geometry, can pose challenges in achieving optimal component positioning and soft-tissue tensioning for stability (26, 27). Furthermore, the choice of surgical approach (e.g., posterior vs. anterior) is a well-documented technical factor influencing dislocation risk (25). Although our study's small sample size precluded statistical significance, these trends suggest a potential need for targeted, risk-stratified approaches. It could involve enhanced preoperative counseling for higher-risk groups, consideration of more stable implant designs (e.g., larger femoral heads, dual-mobility constructs), meticulous surgical technique emphasizing component positioning and soft-tissue repair, and tailored postoperative rehabilitation protocols.

5.1.3. Venous Thromboembolism (VTE)

The VTE incidence of 1.1% is consistent with contemporary studies reporting symptomatic VTE rates of 1–2% following THA when routine pharmacological thromboprophylaxis is administered (28). This suggests that the standard prophylactic protocols at our institution are effective. The single VTE event occurred in an obese (BMI >30) female patient. This aligns with extensive literature identifying obesity as a significant independent risk factor for VTE due to a pro-thrombotic state, reduced mobility, and potentially increased intra-abdominal pressure (28, 29). This case reinforces the critical importance of adhering to and potentially intensifying

prophylaxis in high-risk subgroups, such as obese patients, which may include weight-adjusted anticoagulant dosing and an emphasis on early mobilization.

5.2. The Role of Demographic and Clinical Factors

5.2.1. Body Mass Index (BMI)

No statistically significant association was found between BMI categories and complication rates. This contrasts with numerous studies identifying obesity (BMI ≥30 kg/m²) as a risk factor for increased complications (30, 31). This lack of significance is likely a reflection of our study's limited statistical power, particularly due to the small sample size in the obese subgroup (n=10). Nonetheless, clinically important trends were evident: both dislocation and VTE rates were 10% in the obese group, compared to lower rates in the normal and overweight categories. This pattern suggests a potential dose-response relationship where morbidity risk increases with higher BMI, a phenomenon more pronounced in populations with morbid obesity (BMI >40) (31). Therefore, while not statistically confirmed here, obesity should remain a key consideration in preoperative risk assessment and patient optimization.

5.2.2. Age and Sex

The demographic patterns observed, higher numerical dislocation rates in younger patients and females, and all SSI cases in males, point toward the value of personalized medicine in THA. These patterns suggest that a "one-size-fits-all" approach may be suboptimal. A personalized strategy involves: (1) Preoperative Counseling: Informing younger and female patients about their potentially elevated dislocation risk. (2) Surgical Planning: Considering implant selection and surgical approach based on patient-specific anatomy and risk profile. (3)Postoperative Care: Adapting rehabilitation and activity restrictions for higher-risk individuals. Confirming these associations and integrating them into validated risk-prediction models requires future prospective studies with larger, multicenter cohorts.

5.3. Limitations

The interpretation of our findings must take into account several limitations inherent to the study design. Firstly, its retrospective nature introduces potential biases in data recording and collection. Secondly, the relatively small sample size, particularly within complication subgroups, limited the statistical power to detect significant associations, leading to Type II errors. A post-hoc power analysis confirmed that our study was substantially underpowered (power < 35%) to detect the observed differences in dislocation rates between age and sex groups as statistically significant. Given the severe limitations of sample size and event rates, no meaningful associations between demographic factors and complications can be inferred from these data. Thirdly, as a single-center study, the results may not be fully generalizable to other institutions with different patient populations, surgeon experiences, and clinical protocols. Fourthly, the follow-up period was restricted to one year, excluding later complications. Finally, we could not control for several important confounders, including the specific surgical approach, implant type and size (e.g., femoral head diameter), implant type and design, surgeon volume, and precise control of comorbidities such as diabetes, all of which are known to influence outcomes.

6. Conclusion

In this small, single-center retrospective cohort of 92 patients undergoing primary THA in Iran, the observed rates of SSI (3.3%) and VTE (1.1%) were within ranges reported

internationally. In contrast, the dislocation rate (5.4%) was higher than international averages, a finding that is particularly significant given that the direct lateral approach, associated with greater inherent stability, was used in nearly three-quarters of cases (73.9%). Dislocation was observed more frequently in younger patients and females, though the small number of events precludes any definitive conclusions. The elevated dislocation rate despite the predominant use of a stable surgical approach suggests that factors other than the approach, particularly implant selection (small femoral heads) and patient-specific anatomical variables, may be important contributors to instability in our population. In response to these findings, our center is now considering routine use of larger femoral heads (≥36 mm) where anatomically feasible, selective use of dual-mobility constructs in patients perceived to be at higher risk (e.g., younger females, those with neuromuscular conditions), and enhanced surgical technique training, particularly regarding soft-tissue repair and component positioning. Well-designed, multicenter prospective studies with adequate sample sizes and comprehensive data collection on surgical techniques, implant characteristics, and patient anatomy are urgently needed to accurately determine complication rates and risk factors in the Iranian population.

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Consent for publication: Not applicable.

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