

INCIDENCE OF DISLOCATION AFTER TOTAL HIP REPLACEMENT WITH METAL ON POLYETHYLENE SYSTEM

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Abstract:

Background: Total hip arthroplasty is the preferred treatment for end-stage hip joint disease, preventing dislocations and enhancing durability and functionality. It requires careful planning, surgical precision, and postoperative care.

Objective: To determine the frequency of dislocation after primary total hip replacement with metal on polyethylene system

Material and Methods: This retrospective study was conducted at Mardan Medical Complex Mardan, Mercy Teaching Hospital Peshawar and Mateen Medical Center Peshawar, Pakistan, from September 2020 to September 2024 and examined the clinical records of 145 patients over 40 years old who underwent total hip replacement for end-stage hip disease and proximal femoral fracture surgery. Data was analyzed using descriptive statistical analysis and Chi square test.

Results: The study found a dislocation rate of 9.66% in 14 patients, with 50% occurring in females and 50% in males. Regarding etiology of hip disease 21%, 29% and 50% dislocations occurred in patients undergone total hip arthroplasty for a vascular necrosis of femoral head, osteoarthritis hip and proximal femur fracture respectively (p value= 0.3348). 35.71% patients with poster lateral approach for arthroplasty and 64.29% patients with direct lateral approach for arthroplasty had artificial hip dislocation. 50% patients with inclination angle >45 degrees of acetabular cup and 5% with inclination angle ≤45 degrees of acetabular cup developed artificial hip dislocations.

Conclusion: Acetabular inclination >45° was significantly associated with increased hip dislocation risk in our study sample, suggesting it is an important surgical consideration.

Keywords: Total Hip Arthroplasty; Metal on Polyethylene System, Osteoarthritis, A vascular Necrosis of Hip -

Cite this article: Yar Khan S, Khan F, Samad A, Hussain A, Jan A, Ahmad S. Incidence of Dislocation After Total Hip Replacement With Metal On Polyethylene System. BMC J Med Sci. 2025; 6(1):72-75, <https://doi.org/10.70905/bmcj.06.01.0492>

Introduction:

End-stage hip joint disease refers to a variety of illnesses that substantially impair the durability and functionality of the hip joint. The most common causes of end-stage hip illness include primary osteoarthritis, osteoarthritis caused by trauma, femoral head osteonecrosis, rheumatoid arthritis, and ankylosing spondylitis. Aside from that, Legg-Calvé-Perthes disease and hip developmental dysplasia can both induce end-stage joint disease. Finally, hip joint septic arthritis can cause significant injury and degeneration of the joint. Early stages of hip illness are treated conservatively, but when conservative therapies fail to offer relief, replacement of the natural hip joint with an artificial one is the preferred treatment of choice. Proximal femoral fracture is another indication for hip

replacement surgery.¹

Total hip arthroplasty has a 20-year longevity rate of approximately 85%. A total hip replacement is a form of hip arthroplasty in which both of the femoral and acetabular interfaces are replaced with artificial parts to alleviate discomfort in the hip, normalize articular motions, and optimize hip joint functionality. The ball and socket structure of hip joint is repaired by properly adjusting the surrounding soft tissues and using matching acetabular and femoral components. Total hip prosthesis are made out of many different kinds of materials. Similarly, there are multiple fixing options for total hip replacement components. These include uncemented, cemented, hybrid, and reverse hybrid methods.²

Authorship Contribution: ^{1,5}Substantial contributions to the conception or design of the work; or the acquisition, Data analysis, Literature review, ²Drafting the work or revising it critically for important intellectual content, ^{3,4,6}Final approval of the version to be published, Topic Selection & Supervision

Funding Source: none

Conflict of Interest: none

Received: Dec, 30, 2024

Accepted: June, 26, 2025

Published: Jun 30, 6, 2025

Hip dislocation is one of the most prevalent consequences of hip surgery. In the United States, it is the most prevalent cause of hip revision, while in Sweden and France, it ranks second only to aseptic loosening of artificial hip joint.^{3,4} identical circumstances exists in Lithuania, where repeated dislocations account for 66.2% of all artificial hip joint revisions done following THA.⁵ It is a terrible consequence for both the patient and the surgeon, putting a significant strain on the healthcare system. Dislocation prevention begins with careful planning and assessment before surgery, surgical precision, and appropriate postoperative care. However, approximately 60% of displaced THA will relapse, with 50% requiring revision surgery.⁶ Dislocation can cause significant discomfort, limitation of movement, recurring dislocation, and a low quality of life.⁷The implications of dislocation include frequent hospital admissions and a significant financial burden for both the patient and the healthcare system.^{8,9} According to reports, an early dislocation raised the cost of a primary THR by 342%.¹⁰ and a recurring dislocation raised expenses by 300% in comparison to a single event of dislocation.⁷ To effectively handle single or recurrent dislocations, it is vital to understand the various elements that might cause instability in an artificial hip joint. Based on the foregoing, the purpose of this study was to retrospectively assess the frequency and risk factors of dislocation in a two-centered THR series employing the metal on polyethylene system, with a focus on the impact that acetabular component positioning could have on it.

Material and Method:

Study design: This retrospective cross-sectional study

Setting & duration: Mardan Medical Complex Mardan, Mercy Teaching Hospital Peshawar and Mateen Medical Center Peshawar, Pakistan from September 2020 to September 2024.

Ethical consideration: Ethical approval was obtained from Institutional Research and Ethical Board of Mardan Medical Complex Mardan (Reference N0. 150/Ethic/BKMC, date: 16/10/24).

Sample size: The sample size (n) =145 patients, with anticipated proportion of dislocation in primary total hip replacement (p): 3.5%¹¹ = 0.035, desired level of confidence = (95%): Z-score for 95% is 1.96 and margin of error (E)= 3%, using formulan = $\frac{Z^2 \times p \times (1-p)}{E^2}$.

Inclusion criteria: Both gender, age more than 40 years, who were operated for end-stage hip disease and proximal femoral fracture receiving primary total hip replacement using metal on polyethylene implant system.

Exclusion criteria: The clinical records of all those patients who had per prosthetic fracture, neurological or muscular disorders or any prosthetic joint infection in first 30 days postoperatively were excluded.

Data Collection procedure: We retrospectively studied the clinical records of 145 patients according to

mentioned inclusion/ exclusion criteria. All the included patients had regular postoperative follow up for at least one year or till dislocation or revision due to any cause. Patients details including age, gender, cause of hip joint disease (osteonecrosis of femoral head, hip osteoarthritis, proximal femoral fracture), type of surgical approach (direct lateral or poster lateral), ace tabular inclination angle and any dislocation were obtained.

Statistical analysis: Microsoft excels software version 10 was used for data calculation using descriptive statistical analysis. Chi square test was applied where needed, taking vale of ≤ 0.05 as significant.

Results:

Gender distribution in this study was male 88 (60.69%) and female 57 (35.17%). mean age of the patients was 60.5 ± 9.77 years. regarding etiology of the hip disease 26%, 17% and 57% patients were suffering from avascular necrosis of hip, osteoarthritis hip and proximal femur fracture respectively (fig 1).

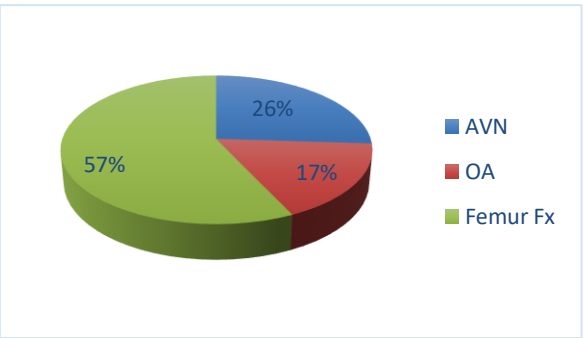


Fig. 1, Distribution of patients according to etiology
Overall dislocations in our study was 14 patients giving dislocation rate of 9.66%.Among these dislocations 7 (50%) occurred in female patients while 7 (50%) occurred in male patients with p value of 0.3890, which is not significant. Regarding etiology of hip disease, 3 (21%), 4 (29%)and 7 (50%) dislocations occurred in patients undergone total hip arthroplasty for avascular necrosis of femoral head, osteoarthritis hip and proximal femur fracture respectivelywith p value of 0.3348, which is not significant statistically (table 1).

Table, 1. Distribution of dislocations among etiologies of hip disease			
Etiology	No. of patients	%	P value
AVN	3	21	0.33478
OA	4	29	
Proximal femur fracture	7	50	

5 (35.71%) patients with poster lateral approach (PLA) for arthroplasty and 9 (64.29%) patients with direct lateral approach (LA) for arthroplasty had artificial hip dislocation with p value of 0.9829 which was not significant.8 (50%) patients with inclination angle >45 degrees of acetabular cupand 6 (5%) with inclination angle≤45 degrees of acetabular cup developed artificial hip dislocations with p value of< 0.00001 which is significant (table 2).

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cup and 6 (5%) with inclination angle ≤ 45 degrees of acetabular cup developed artificial hip dislocations with p value of < 0.00001 which is significant (table 2).

Table, 2. Distribution of dislocations among different operative parameters			
Parameter	No. of patients	%	P value
PLA	5	35.71	0.9829
LA	9	64.29	
inclination angle $> 45^\circ$	8	50	< 0.00001
inclination angle $\leq 45^\circ$	6	5	

Discussion:

Total hip arthroplasty (THA), commonly known as total hip replacement, is a surgical procedure that has become a gold standard in orthopedic care for the treatment of severe hip joint degeneration or damage. This operation involves the removal of diseased bone and cartilage from the hip joint and replacing it with artificial components. By effectively addressing the root cause of hip pain and dysfunction, THA can dramatically alleviate suffering, restore a patient's ability to perform daily activities, and significantly enhance their overall quality of life.¹² Dislocation following total hip arthroplasty (THA) continues to be a significant and unresolved challenge in orthopedic surgery. Despite substantial advancements in implant technology and the expertise of surgeons, the frequency of dislocation has remained relatively constant over the past several decades. The precise factors contributing to this complication are not fully understood, with a multitude of potential causes implicated. This lack of consensus regarding risk factors underscores the complexity of the issue and the ongoing need for research to identify effective prevention strategies.¹³

The present retrospective study assessed the frequency and predictors of hip dislocation in first 2 years after primary THA using metal on polyethylene implant system for various hip diseases as in Pakistan most of the surgeons use metal on polyethylene implant system. The rate of dislocation after primary THR with a metal-polyethylene joint is usually between 3% and 5%,¹⁴⁻¹⁶ although there are studies where an even greater dislocation rate has been found.^{17,18} In the current study we observed the dislocation rate of 9.66% in metal on polyethylene system of total hip arthroplasty. Gillinov *et al* in their study observed that 26.2% of total hip arthroplasty using metal on polyethylene system resulted in artificial hip joint dislocation.¹⁹ The 10-year cumulative dislocation rate reported by Baker *et al* was 3.2%.²⁰ These variations in the results of the studies conducted by other researchers and our study are due to the fact that all these studies are conducted at different parts of the globe where the life style of the people of each one like transportation, toilet facilities and living standards greatly vary from each other. Hence all these factors may influence the results of the studies. Similarly the mean follow up period greatly vary from study to study. Another aspect of hip prosthesis which makes it resistant to dislocation is larger head size but neither our study nor all other studies properly indicated the head sizes in patients with hip joint dislocations.

In our study the artificial hip dislocation rates are equal in male and female gender. These observations are

contrary to the results reported by Caeiro *et al* and Gillinov *et al* where female patients were having more dislocations as compared to female patients.^{19,21} Gillinov *et al* depended on database search and the other one is having very negligible difference in number of male and female patients experiencing dislocations. Hence the results of our study are nearly comparable the study of Caeiro *et al*. Moreover, gender was statistically significant neither in our study nor in study by other researchers.

Woo and Morrey²² found 5.8% dislocations in THR using a posterolateral operative approach. Levi and Gebuhr¹⁹ validated these findings in 2001, with 5.6% of dislocations in a series of 427 primary THRs using a posterolateral surgical approach.²³ They found fewer dislocations in anterolateral and direct lateral surgical approaches. Caeiro *et al* discovered 5 dislocations of artificial hip joint using the posterior surgical approach and only 1 dislocation using the lateral surgical approach but there were no statistically significant differences between the control group ($P = 0.699$) or the total series ($P = 0.168$).²¹ Although we discovered 5 dislocations of hip replacements utilizing the posterolateral surgical approach and 9 using the lateral approach and there were no significant statistical differences between the two procedures ($P = 0.9829$).

We observed that most of the artificial hip dislocations (57.14%) occurred in the first 3 months following total hip arthroplasty. Similar observations were noted by Gillinov *et al* who observed that 52% total hip dislocations occurred within 3 months following the surgery.²¹ Woo and Morrey found that 59% of first-time dislocations occurred within the first 3 months after surgery,²⁴ and Hermansen *et al*. found 75% of first-time dislocations in the same period.¹¹

The current study also discovered that individuals under the age of 65 were substantially more likely to experience dislocation following THA than those 65 and older. This finding contradicts prior research that found that advanced age is related with a greater likelihood of dislocation.^{11,24} The cause for this differential is unclear, however the higher frequency of dislocation in younger patients in the current study might be due to higher levels of first postoperative activity or more complex presenting disease in this patient cohort. Gillinov *et al*.²¹ had comparable observations to ours. However, the findings of our investigation were not statistically significant.

In terms of surgical factors, cemented implants were related with an increased risk of dislocation but with a nonsignificant statistical p value of 0.35571. This contradicts previous research, which concluded that cemented fixation were linked to a lower risk of dislocation, however Kunutsor *et al*. discovered that cemented femoral component fixations weren't linked with a change in dislocation risk, whereas cemented acetabular component fixations were secure regarding dislocation.^{11,24} This conclusion requires additional investigation, although it may be resolved by understanding the precise indications for the application of cemented implant designs, as well as by doing a comprehensive evaluation of implant alignment, both of which are shortcomings in the present study.

In our study, those patients with acetabular cups inclination angle of >50degrees dislocated more often than those with acetabular cup inclination angle of ≤50 degrees. This was the only statistically significant risk factor we observed in our study. Sanz-Reig J *et al* also observed the acetabular inclination angle >50 degrees to be associated with artificial hip joint dislocation.²⁵

This study has some limitations. As it is retrospective study so some possible risk factors for dislocation of the artificial hip joint like femoral stem inclinations, acetabular anteversion, femoral offset, femoral head and acetabular cup sizes and BMI of the included patients were not available from patients record and hence not taken into account.

Conclusion:

Acetabular inclination >45° was significantly associated with increased hip dislocation risk in this group, suggesting it is an important surgical consideration.

Conflict of interests: None

Source of funding: None

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