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Orthopaedics

LENGTH OF STAY AND COMPLICATION CASCADE : OUTCOMES OF PRIMARY TOTAL HIP REPLACEMENT IN DIABETIC INDIVIDUALS

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ABSTRACT **Objective:** Total hip replacement stands out as a highly successful and beneficial surgical intervention globally. The experiences of diabetic patients undergoing hip replacement are not as well-documented as those of their non-diabetic counterparts, largely due to the potential for less favourable results associated with diabetes. This investigation sought to evaluate the outcomes of total hip replacement surgery when performed on individuals with diabetes compared to those without the condition. **Materials and Methods:** Forty individuals with osteoarthritis received a cemented primary total hip replacement. These participants were divided into two groups: one consisting of 30 patients with diabetes and another of 30 patients without diabetes. The effectiveness of the surgery was assessed using the modified Harris Hip Score in all individuals, and any complications (such as surface wound issues, deep infection, fracture around the implant, loosening, and bone loss) were noted in both groups. **Results:** Individuals with diabetes mellitus experienced longer hospitalisations and higher total expenses. Furthermore, the diabetic group had a greater need for blood transfusions after surgery. While the diabetic group exhibited a higher incidence of complications compared to the non-diabetic group, this difference was not statistically significant. The research indicated that higher body weight negatively affected the functional outcomes in both patient groups. **Conclusion:** Patients with diabetes who undergo hip replacement constitute a high-risk population requiring careful monitoring of their blood sugar levels during the period surrounding the surgery. This is because diabetic patients experienced more postoperative complications, needed longer hospital stays, and incurred greater overall costs when compared to non-diabetic patients.

KEYWORDS : Diabetes Mellitus, Functional Outcome, Total Hip Arthroplasty, Periprosthetic Infection,

INTRODUCTION

Total hip arthroplasty (THA) is a successful surgery that improves mobility and reduces pain for individuals with joint degeneration, its utilisation being continuously increasing.[1] However, the rising incidence of diabetes has led to a gap in understanding how diabetic patients fare during THA compared to non-diabetic patients. Hyperglycemia's negative effects on the musculoskeletal system are now evident in several reports.[2] It is also linked in studies to a higher risk of other unfavourable outcomes such as thromboembolism, fracture, and death,[3,4] potentially because diabetes affects osteoblast and osteoclast function.Diabetes can cause complications, including glucose imbalances during surgery, which may lead to longer hospital stays and worse outcomes. Elevated blood sugar can impair immune function, increasing the risk of infections like periprosthetic joint infection (PJI), which affects up to 3% of THA patients. Poorly controlled diabetes is particularly linked to higher rates of PJI. This study aims to compare THA outcomes in diabetic and non-diabetic patients, focusing on recovery and complications.

MATERIALS AND METHODS

This prospective study involved 60 participants. These individuals were divided into two groups: a diabetic group, comprising 30 patients, and a non-diabetic group, also comprising 30 patients. All participants underwent primary cemented total hip replacement as a treatment for osteoarthritis of the hip via a lateral surgical approach at Karmuz Health Insurance Hospital in Alexandria between May 2015 and January 2016. The duration of follow-up ranged from 6 to 14 months, with an average follow-up period of 10 months.

A comprehensive preoperative assessment, including clinical and radiological examinations along with routine laboratory tests, was conducted for each participant. Postoperative clinical and radiological evaluations were also performed.

All participants were assessed for the following:

(1) Personal history, including name, age, sex, occupation, history of prior fractures (particularly of the lower limb), and pre-existing medical conditions such as diabetes mellitus, hypertension, and cardiac, kidney, or respiratory issues.
(2) General physical examination to assess the patient's overall health, a systemic review to identify any associated deformities, and a local examination of the hip, including skin condition, limb alignment, range of motion, and leg-length discrepancy.
(3) Preoperative standard X-rays, including anteroposterior and lateral views of the hip joint and proximal femur, and post-operative radiographs to evaluate the position of the acetabular cup (inclination and anteversion), the position of the femoral stem, the bone cement, the size and fit of the femoral head within the cup, and any complications (e.g., osteolysis and loosening).
(4) Routine laboratory investigations for each participant, including a complete blood count, fasting and 2-hour postprandial blood glucose levels, HbA1c, erythrocyte sedimentation rate, C-reactive protein, bleeding and clotting times, prothrombin time and concentration, liver enzymes, blood urea nitrogen, and creatinine levels.

Methods of Assessment

Outcome evaluation was performed at 2 weeks postoperatively using the Harris Hip Score to determine the functional capacity of each participant. A final evaluation was then conducted after 6 months to ascertain the ultimate functional ability of each patient using the same scoring system. Scores exceeding 90 were categorised as excellent, scores between 81 and 90 as good, scores between 71 and 80 as fair, and scores below 70 as poor.

Data were entered into a computer and analysed using IBM SPSS software package version 20.0 (SPSS Inc., Chicago, Illinois, USA). Qualitative data were presented as counts and percentages. Quantitative data were presented as the range (minimum and maximum), mean, standard deviation (SD), and median. Statistical significance was determined at a p-value of 0.05.

RESULTS

All participants in the diabetic group had type II diabetes mellitus and were managing their condition with oral hypoglycaemic medications at home. Their HbA1c levels were below 7% upon admission; their blood glucose was managed with insulin during their hospital stay.

The ages of the participants ranged from 40 to 70 years, and their body weight ranged from 60 to 100 kg in both groups. The reasons for undergoing THA in this study included primary osteoarthritis of the hip, fracture of the femoral neck with subsequent osteoarthritis due to avascular necrosis of the femoral head, and acetabular fractures.

A statistically significant difference was observed within both groups when comparing preoperative and postoperative Harris Hip Scores. In

the diabetic group, the preoperative Harris Hip Scores ranged from 27 to 55 points, with a mean of 50.90 points, while the postoperative scores ranged from 56 to 97 points, with a mean of 85.25 points. Similarly, in the non-diabetic group, the preoperative Harris Hip Scores ranged from 27 to 54 points, with a mean of 47.95 points, and the postoperative scores ranged from 57 to 96 points, with a mean of 86.90 points (Table 1).

Table 1 Comparison Between Two Groups According to Total Harris Hip Score

Total Harris Hip Score	Diabetic (n=30)	Nondiabetic (n=30)	t	P
Preoperative				
Minimum،maximum	25.0،57.0	26.0،55.0		
Mean±SD	51.50±6.10	48.55±8.90	1.450	0.152
Median	53.0	50.0		
Postoperative				
Minimum،maximum	55.0،98.0	58.0،97.0		
Mean±SD	84.80±10.95	87.50±9.15	0.820	0.416
Median	88.0	91.0		
P1	<0.001*	<0.001*		

*Student's t-test was used for comparing between the two groups. P1, P value for paired t-test for comparing between preoperative and postoperative. *P≤0.05, statistically significant.

This study demonstrated a significant increase in the total duration of hospital stay in the diabetic group, with an average of 12.15 days compared to 6.05 days in the non-diabetic group (P = 0.047) (Table 2).

Table 2 Comparison Between the Two Groups According to Total Hospital Stay (Days)

Total hospital stay (days)	Diabetic (n=30)	Nondiabetic (n=30)	Test of significance	P
Minimum،maximum	5.0،55.0	4.0،25.0		
Mean±SD	13.50±13.50	6.50±4.50	t=2.150*	0.038*
Median	9.0	5.5		

Although not statistically significant, the diabetic group exhibited a higher occurrence of complications compared to the non-diabetic group: superficial wound complications occurred in 10% of the diabetic group and 5% of the non-diabetic group; deep infection rates were 10% in the diabetic group and 5% in the non-diabetic group; and one patient in the diabetic group experienced a periprosthetic fracture, while none occurred in the non-diabetic group. The proportion of patients experiencing procedure-related complications in the diabetic group was 25%, compared to only 5% in the non-diabetic group (Table 3).

Table 3 Comparison Between the Two Groups According to Total Complications

	Diabetic (n=30) (n (%))	Nondiabetic (n=30) (n (%))	χ^2	FEP
Superficial wound complication				
No	27 (90.0)	29 (96.7)	0.822	0.410
Yes	3 (10.0)	1 (3.3)		
Deep infection				
No	27 (90)	29 (96.7)	2.051	0.152
Yes	3 (10)	1 (3.3)		
Periprosthetic fracture				
No	29 (96.7)	30 (100.0)	1.017	0.313
Yes	1 (3.3)	0 (0.0)		
Total complications			2.857	0.091
No	23 (76.7)	29 (96.7)		
Yes	7(23.3)	1 (3.3)		

χ^2-Test was used for comparing between the two groups. FE, Fisher exact for the χ^2-test.

The need for postoperative blood transfusion was significantly higher in the diabetic group, with 19 (63.3%) patients requiring transfusion postoperatively, compared to only 6 (20%) patients in the non-diabetic group (P = 0.004).

In this study, a significant correlation was found between functional outcome and patient weight in both groups. In the diabetic group, the average weight for those with satisfactory results was 78.69 ±7.91 kg, while it was 89.25 ±6.60 kg for those with unsatisfactory results (P = 0.025). In the non-diabetic group, the average weight for patients with satisfactory results was 80.22 ±5.60 kg, while it was 96.0 ±2.83 kg for those with unsatisfactory results (P = 0.001). Furthermore, a significant relationship existed between periprosthetic infection and functional outcome, with patients experiencing infective complications achieving unsatisfactory outcomes (P = 0.010) (Table 4).

Table 4 Relation Between Functional Results (Postoperative) and Infective Complications in the Diabetic Group (n=30)

Functional results	No Infection (n) (%)	Infection (n) (%)	P-value
Excellent (n=14)	14 (100.0)	0 (0.0)	0.002*
Good (n=10)	9 (90.0)	1 (10.0)	0.008*
Fair (n=3)	2 (66.7)	1 (33.3)	0.035*
Poor (n=3)	0 (0.0)	3 (100.0)	<0.001*
Satisfactory (Excellent + Good + Fair)	25 (83.3)	2 (66.7)	0.045*
Unsatisfactory (Poor)	0 (0.0)	3 (100.0)	

*Significant value P less than 0.05. *** P-value for the comparison of Satisfactory vs. Unsatisfactory outcomes between those with and without infection.

DISCUSSION

Diabetes mellitus encompasses a group of metabolic disorders characterised by elevated blood sugar levels resulting from defects in insulin production, insulin action, or both. The persistent high blood sugar associated with diabetes can lead to long-term damage, dysfunction, and failure of various organs, particularly the eyes, kidneys, nerves, heart, and blood vessels

Diabetes contributes to less favourable outcomes following orthopaedic surgery, including infection, increased pain and stiffness, reduced joint function, decreased range of motion, a higher likelihood of not being discharged home directly, and a reduction in the lifespan of the implant, often requiring subsequent revision surgery. Marchant et al.[7] investigated the association between the degree of diabetes mellitus and complications. They showed that uncontrolled diabetes mellitus is associated with more than three folds increase in risk of stroke, two folds increase in risk of surgical site infections and three folds increase in risk of mortality. A higher rate of complications was observed in the diabetic group relative to the non-diabetic group.[8]

In a study involving 6,088 total hip arthroplasty procedures, Harris et al.[9] reported a higher risk of complications when HbA1c exceeded 7%. Similarly, Stryker et al.[10] showed that HbA1c levels above 6.7% were associated with increased postoperative wound complications.

All diabetic patients in this study had their blood glucose levels managed with subcutaneous insulin during their hospital stay and were transitioned back to oral medication upon discharge. Patients who developed infective complications were continued on insulin treatment even after discharge for improved blood glucose control.

Moeckel et al.[11] reviewed the outcomes of 93 hip replacements in 78 diabetic patients. They observed that patients who were not previously dependent on insulin required it during the perioperative period. The authors concluded that this temporary insulin dependence was due to a worsening of their diabetic condition. Therefore, stress-induced hyperglycaemia can occur even in patients undergoing elective arthroplasty surgery and may potentially affect systemic outcomes in both the short and long term.

In the diabetic group, the average preoperative Harris Hip Score was 50.90 ±5.77, compared to the average postoperative score of 85.25 ± 10.59. In the non-diabetic group, the average was 47.95 ±8.54 preoperatively and 86.90 ±8.74 postoperatively. This indicates a significant improvement in the score 6 months after surgery in both groups (P < 0.001).

This finding aligns with the results reported by Ng et al.[12] in their 2007 study, which also showed a significant improvement in Harris Hip Score 6 months after the procedure (P < 0.001).

The overall Harris Hip Score showed no significant difference between the two groups, with an average of 85.25 ±10.59 in the diabetic group and 86.90 ±8.74 in the non-diabetic group.

Our findings are consistent with the results reported by Chun et al.[13],

who stated that the Harris Hip Scores for the diabetes mellitus group and the non-diabetes mellitus group before surgery were 63 and 65 (P = 0.295), respectively, and at the final follow-up, were 92 and 94 (P = 0.3), respectively, indicating no significant difference.

In this study, established periprosthetic infection significantly affected functional outcome (P = 0.032) in the diabetic group with infected patients who achieved unsatisfactory results. This is in agreement with the results reported by Mittag et al.[14] in their publication, which stated that patients with PJI had lower Harris Hip Score s compared with those without infection, as patients under the study with established infection had a lower score with an average of 70 points

CONCLUSION

The present case series, despite its limited size, demonstrates that the procedure yielded significant benefits in functional outcomes for both diabetic and non-diabetic patients. However, increased attention should be paid to blood glucose management in the diabetic group.

The present investigation provided evidence that a pre-existing diagnosis of diabetes mellitus was associated with a significant prolongation of the total duration of hospitalisation. Furthermore, our analysis revealed a trend towards a higher incidence of orthopaedic complications, particularly infection, in the diabetic cohort, which had a detrimental impact on their functional outcomes.

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