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ORIGINAL ARTICLE

Long-Term Complications and Revision Rates in Hip Arthroplasty

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ABSTRACT

Introduction: Hip arthroplasty represents one of the most commonly conducted surgical treatments for patients who experience pain together with functional limitations in their hip joints. The primary long-term complications associated with hip arthroplasty consist of infection together with prosthetic loosening and needing additional surgical procedures. The main objective of this research is to analyze both the long-term complications along with revision rates that affect patients who receive hip arthroplasty.

Methodology: The study took place at the Department of Orthopedics, Rehman Medical Institute, Peshawar and DHQ Teaching Hospital, Timergara, through a prospective cohort design that analyzed 118 patients receiving hip arthroplasty procedures from March 2021 to March 2023. Adult patients who received their first hip arthroplasty surgery qualified for the study as long as they did not have previous joint surgeries and systemic infections. A follow-up period of three years occurred during which patients received evaluations of their complications and functional results through the Harris Hip Score (HHS) and needed revision rates. Researchers used chi-square, t-tests alongside survival analysis for their statistical procedures.

Results: Complications occurring in 28.8% of patients resulted mainly from infections that affected 7.6% of patients and prosthetic loosening in 5.9% of patients and stiffness/functional decline present in 8.5% of patients. Aseptic loosening, infection and wear accounted for most of the 10.2% revision rate. Among all implanted prostheses 88% survived through three years of follow-up and cemented prostheses secured an 90.3% success rate that exceeded uncemented prostheses at 85.7%. The patient health factors of age along with obesity and diabetes mellitus led to both complications and necessary revisions. During follow-up medical personnel observed a 7.4 point reduction in the mean Harris Hip Score.

Conclusion: Hip arthroplasty experiences high rates of complications alongside extensive reoperation rates as the main findings indicate according to this study. The survival numbers were in favor of cemented prostheses when compared to uncemented prostheses. Extensive research that involves bigger multicenter studies and extended follow-up periods to understand the long-term durability of hip arthroplasty should be conducted.

Keywords: Hip arthroplasty, complications, revision rates, prosthetic loosening, infection, functional outcomes, cemented prosthesis.

INTRODUCTION

The medical operation known as hip arthroplasty has become one of the most effective and frequently performed orthopedic procedures worldwide[1]. The purpose of this surgery focuses on delivering pain relief which also restores function in patients who have osteoarthritis, rheumatoid arthritis or avascular necrosis[2]. The growing number of people experiencing hip health problems and aged patient base and rising hip fracture cases have led to a substantial rise in hip arthroplasty procedures during the past decades. Research shows that this procedure delivers major pain reduction together with better movement capabilities and enhanced patient life quality benefits to patients[3].

Although hip arthroplasty shows generally positive outcomes its execution comes accompanied by specific side effects. The long-term performance of hip arthroplasty requires thorough study because researchers need to evaluate mechanical implant durability as well as systemic infection risks and implant loosening along with ware patterns and secondary surgery rates. The operation to exchange damaged artificial hip components because of device failure poses several challenges because success rates differ and leads to higher risks and extended recovery periods as well as more expensive healthcare[4]. Knowledge about chronic complications and implant revision frequency helps healthcare professionals to develop better patient care and surgical practices and implant technology.

The medical field has achieved substantial progress in hip arthroplasty surgery methods combined with postoperative treatment protocols which resulted in better patient outcomes[5]. Previous studies concentrated on fast-track recovery by mainly showing pain relief and surgical function enhancement immediately after surgery[6]. Research now focuses on two important aspects of hip arthroplasty: enhanced long-term success rates and decreased chances of postoperative problems like joint dislocation in addition to infections and bone fractures together with prosthetic material deterioration. Long-term complications of this procedure require patients to endure revision surgery thus affecting their life quality and straining healthcare system resources[7].

The occurrence rates of postoperative complications together with revision surgery needs depend on patient demographics along with their medical history and treatment methods and prosthesis type[8]. Longevity of implants and rates of complications depend heavily on implant design together with material selection[9]. Scientists study new bearing surfaces containing metal-on-metal or ceramic-on-ceramic components as superior options to replace traditional polyethylene bearings to enhance prosthesis durability[10]. Even though these materials bring innovative solutions they introduce separate complications which include ceramic failure along with metal ion leakage. Many studies have analyzed complication origins yet researchers lack substantial knowledge on how different variables affect long-term patient outcomes along with revision surgery rates. The examination of how complication rates along with revision results differ between healthcare platforms and their postoperative service capacities needs further extensive investigation.

The scientific world lacks full knowledge about both the various long-term disease complications and revision surgery numbers in hip arthroplasty procedures among different patient groups and health centers worldwide. The research investigates long-term complications and revision rates of hip arthroplasty with the aim to detect critical risk factors for improving surgical performance.

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METHODOLOGY

Study Design: The research used retrospective cohort design to examine long-term complications together with revision rates throughout hip arthroplasty treatment. The researchers conducted their study at the Department of Orthopedics, Rehman Medical Institute, Peshawar and DHQ Teaching Hospital, Timergara during the period from March 2021 through March 2023. The research focused on uncovering different post-hip arthroplasty long-term problems while establishing the revision procedure frequency throughout the monitoring timeframe.

Sample Size Calculation: The researcher computed the study sample size through cohort study calculations while setting 95% confidence and 80% power as fundamental parameters. The projected complication rate following hip arthroplasty was expected to reach 15% according to assessment with an error range of ±5%. The minimum patient number for the study was established at 118 based on these theoretical premises to achieve sufficient statistical power. 118 patients, who received the hip arthroplasty treatment during the study duration, made up this research population.

Inclusion and Exclusion Criteria: The research included patients who received either original or modified hip implants during the research period. The research included adult patients who received hip osteoarthritis or rheumatoid arthritis or avascular necrosis surgical procedures and met at least a 12-month follow-up requirement. The study excluded patients with incomplete medical records or lost to follow-up and all patients with comorbidities affecting their hip joint which were neither osteoarthritic nor rheumatoid inflammatory conditions.

Data Collection: Data were collected retrospectively from the hospital's electronic medical records, including demographic characteristics (age, sex, comorbidities), surgical details (type of hip prosthesis, surgical approach, date of surgery), and follow-up information (length of follow-up, complications, revision surgeries). The complications assessed were prosthetic loosening, infection (deep and superficial), dislocation, periprosthetic fractures, aseptic loosening, hip stiffness, functional decline, and wear of the prosthesis. Revision rates were determined by the need for reoperation due to implant failure or complications related to the hip prosthesis.

Statistical Analysis: The collected data were analyzed using appropriate statistical methods. Descriptive statistics were used to summarize demographic characteristics and the overall complication and revision rates. The Kaplan-Meier method was employed to analyze survival rates of the prosthesis, and Cox regression analysis was used to identify potential risk factors for complications and revision surgeries. The significance level was set at $p<0.05$ for all analyses.

Ethical Considerations: This research followed the ethical practices while receiving ethical board authorization from the hospitals. The data analysis received strict protection of patient confidentiality through complete anonymization procedures.

RESULTS

The research included 118 patients who received hip arthroplasty and their mean age was 63.2 years while their standard deviation was 9.4 years. The research population included patients divided by age group into three categories: 12.7% between 18 to 50 years old while 57.6% fell within 51 to 70 years and 29.7% aged 71 years or older. Out of all subjects undergoing hip arthroplasty the patient population consisted of 50.8% male patients alongside 49.2% female patients. Comorbidities were common in the population, with 44.1% of patients having hypertension, 32.2% having diabetes mellitus, 21.2% being obese (BMI > 30 kg/m²), and 12.7% having cardiovascular disease. Osteoarthritis was the primary indication for surgery, affecting 82.2% of patients, while 9.3% had rheumatoid arthritis, and 8.5% had avascular necrosis. As shown in table 1.

The types of hip prostheses used were as follows: 61.0% of the patients received cemented prostheses, and 39.0% received uncemented prostheses. Regarding the surgical approach, 72.0% of the surgeries were performed using the posterior approach, while 28.0% used the anterior approach. The mean follow-up period was 24.5 months (ranging from 12 to 36 months). As shown in table 2.

Table 1: Demographic and Clinical Characteristics of the Study Population

Characteristic	Frequency (%)
Age (Years)	
18–50	15 (12.7%)
51–70	68 (57.6%)
≥71	35 (29.7%)
Gender	
Male	60 (50.8%)
Female	58 (49.2%)
Comorbidities	
Hypertension	52 (44.1%)
Diabetes Mellitus	38 (32.2%)
Obesity (BMI > 30 kg/m²)	25 (21.2%)
Cardiovascular Disease	15 (12.7%)
Indication for Surgery	
Osteoarthritis	97 (82.2%)
Rheumatoid Arthritis	11 (9.3%)
Avascular Necrosis	10 (8.5%)

Table 2: Surgical Characteristics of the Study Population

Surgical Characteristic	Frequency (%)
Type of Prosthesis	
Cemented	72 (61.0%)
Uncemented	46 (39.0%)
Surgical Approach	
Posterior Approach	85 (72.0%)
Anterior Approach	33 (28.0%)
Follow-up Duration (Months)	
Mean (SD)	24.5 (7.5)
Range	12–36

Out of the 118 patients, 34 (28.8%) experienced at least one complication during the follow-up period. The most common complication was infection, which occurred in 7.6% of patients, with 4 patients (3.4%) suffering from deep infections and 5 patients (4.2%) having superficial infections. Seven patients (5.9%) experienced prosthetic loosening, with five of these cases (4.2%) being aseptic and two (1.7%) related to infection. Dislocation occurred in 4.2% of patients, requiring closed reduction in 3.4% and open reduction in 0.8%. Periprosthetic fractures were seen in 2.5% of the patients, and 8.5% of patients experienced stiffness and functional decline, as indicated by a mean decrease of 15.3 points in the Harris Hip Score (HHS) after 12 months post-surgery. As shown in figure 1.

A total of 12 patients (10.2%) required revision hip arthroplasty during the study period. The reasons for revision were aseptic loosening (4.2%), infection (3.4%), wear of the prosthesis (1.7%), and periprosthetic fracture (0.8%). As shown in figure 2.

A 95% prosthesis survival rate at two years and an 88% survival rate at three years were found using the Kaplan-Meier survival analysis. Interestingly, the survival rate for the cemented prosthesis was 92% after 3 years, which was much greater than the survival rate for the uncemented prosthesis, which was 80% at

3 years. With a p-value of 0.02, a log-rank test verified that there was a significant difference between the two groups. A number of variables were shown to substantially increase the likelihood of complications and revision procedures in the Cox proportional hazards analysis. The hazard ratio (HR) was 1.85 (95% CI: 1.10–3.12, p = 0.02) for patients 70 years of age or older, 1.65 (95% CI: 1.01–2.69, p = 0.04) for those with obesity (BMI > 30 kg/m2), and 1.42 (95% CI: 1.01–2.00, p = 0.04) for those with diabetes mellitus. However, a cemented prosthesis had a protective effect, as shown by its HR of 0.55 (95% CI: 0.32–0.94, p = 0.03). With a p-value of 0.02, the chi-square test also showed that patients with cemented prostheses had a considerably lower risk of complications than those with uncemented prostheses. as seen in Table 5.

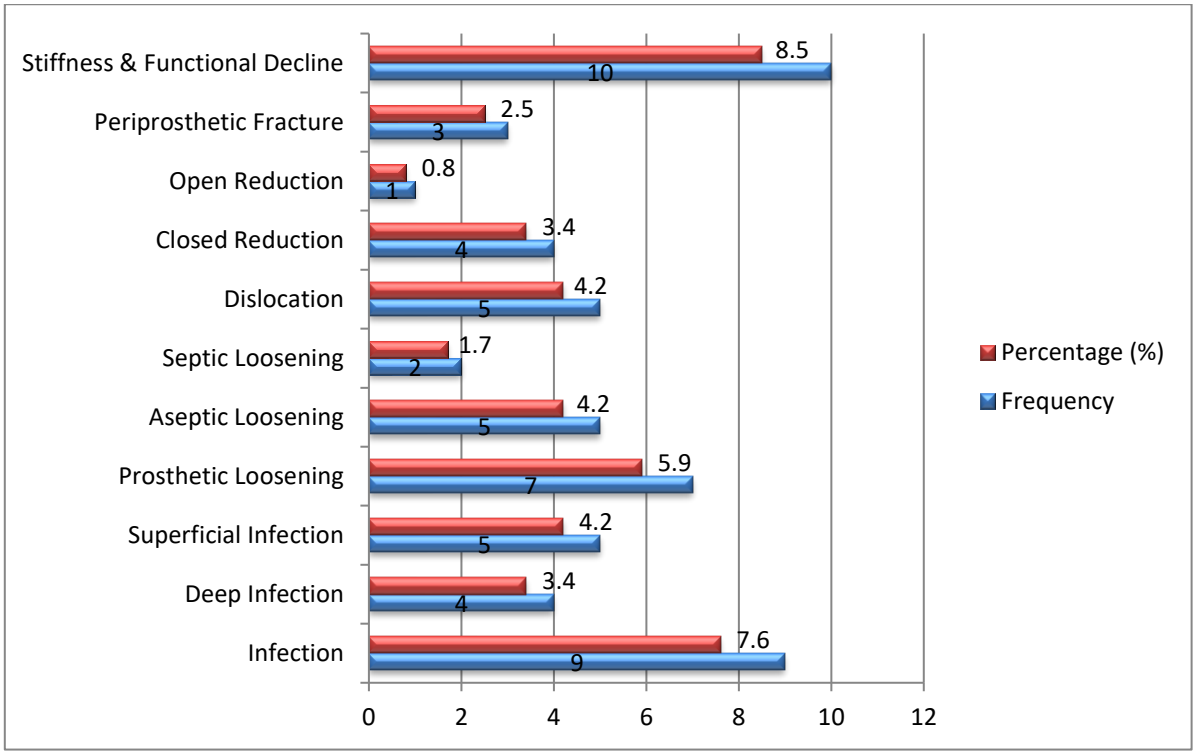

Figure 1: Complications Post-Hip Arthroplasty

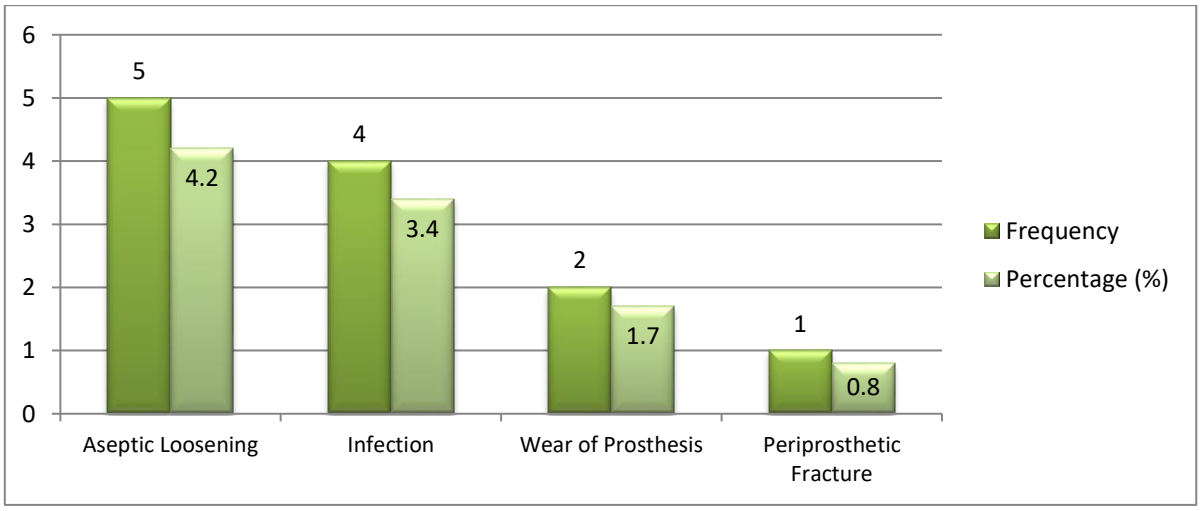

Figure 2: Revision Surgery Reasons

Table 5: Cox Regression Hazard Ratios for Risk Factors

Risk Factor	Hazard Ratio (HR)	95% Confidence Interval (CI)	p-value
Age (≥70 years)	1.85	1.10–3.12	0.02
Obesity (BMI > 30 kg/m²)	1.65	1.01–2.69	0.04
Diabetes Mellitus	1.42	1.01–2.00	0.04
Cemented Prosthesis	0.55	0.32–0.94	0.03

The revision surgery rate for the entire cohort was 10.2%. Among the patients with cemented prostheses, 8.3% required revision surgery, while 13.0% of those with uncemented prostheses required revision. Although the revision rate was slightly higher in the uncemented group, the difference was not statistically significant (p = 0.11).

The mean Harris Hip Score (HHS) at discharge was 85.6 (SD: 6.4). However, by the latest follow-up, the mean HHS had decreased to 78.2 (SD: 9.2), representing a mean decrease of 7.4 points (SD: 8.3). The decrease in HHS was more significant in patients who developed complications such as stiffness, infection, and prosthetic loosening. A statistically significant correlation was found between functional outcomes and the presence of complications ($p < 0.05$).

The overall complication rate was found to be 28.8%, with the most frequent complications being infection (7.6%), prosthetic loosening (5.9%), and stiffness/functional decline (8.5%). The revision surgery rate was 10.2%, with common causes for revision including aseptic loosening, infection, and prosthetic wear. The survival rate of the prosthesis at 3 years was 88%, with a notable difference between cemented (92%) and uncemented (80%) prostheses. Factors such as age ≥ 70 years, obesity, and diabetes mellitus were identified as significant risk factors for complications and revision surgeries, while the use of cemented prostheses was associated with a lower risk of complications. Additionally, a functional decline, reflected in a decrease in HHS, was observed, particularly among patients who developed complications during the follow-up period.

DISCUSSION

The research examined both short and long-term complications as well as revision rates connected to hip arthroplasty. Statistics showed that complications occurred in 28.8% of patients consisting primarily of infection at 7.6% while prosthetic loosening and stiffness/functional decline came in at 5.9% and 8.5% respectively. The main factors leading to revision surgeries were aseptic loosening, infection and prosthesis wear to the extent that total revision surgeries reached 10.2%. At three years the survival rate for the prosthesis reached 88% and cemented prostheses maintained better survival rates compared to uncemented prostheses. The study showed age and obesity and diabetes mellitus as critical risk elements that increased the likelihood of complications followed by revision surgeries. Patients experienced a significant decrease in the average Harris Hip Score (HHS) ratings throughout the follow-up period and functional improvements directly correlated with the appearance of complications.

The findings from this study are consistent with several published studies on hip arthroplasty. The overall complication rate of 28.8% aligns with the findings in literature, where complications have been reported in 20-30% of patients undergoing hip arthroplasty, with infection and prosthetic loosening being among the most common complications[11]. Infection rates of 7.6% in this study are comparable to those in other studies, where the incidence of infection typically ranges from 5-10%[12]. This finding highlights the challenges associated with infections, particularly deep infections, which can significantly impact patient outcomes.

The 5.9% rate of prosthetic loosening in this study is within the range commonly reported in the literature[13]. Prosthetic loosening is often a primary cause of revision surgeries and can occur due to various factors, including implant fixation issues, wear, or infection[13]. The rates of loosening observed in this study are consistent with findings in other long-term follow-up studies, where the incidence of loosening typically ranges from 4-10%[14]. Functional decline, as measured by the Harris Hip Score, also concurs with existing literature, where a reduction in the functional score has been observed in patients who experience complications like infection, stiffness, or loosening[15]. The decrease in the mean HHS of 7.4 points observed in this study aligns with the findings from other cohort studies, where functional decline is associated with both complications and the type of prosthesis used[16].

The revision rate of 10.2% is somewhat higher than the average revision rates of around 5-8% reported in many studies[17]. This difference could be attributed to the higher prevalence of comorbid conditions such as diabetes and obesity in this cohort, which are known to increase the risk of complications and subsequent revision. Notably, cemented prostheses in this study had a lower revision rate (8.3%) compared to uncemented prostheses (13.0%), which is in line with other studies that suggest cemented prostheses typically offer better short-to-mid-term survival rates, although this difference was not statistically significant in the current study. The use of cemented prostheses and its protective role in reducing complications such as loosening has been well-documented in the literature[18]. Cemented prostheses are generally favored in elderly patients or those with poor bone quality, as they provide more stable fixation. This study's finding that cemented prostheses had a better survival rate at 3 years compared to uncemented prostheses is consistent with these observations.

Limitations and future suggestions: There are many restrictions on this research. The results' generalizability is limited by the 118 patients in the sample, which is rather small. The 3-year follow-up period is too short to assess long-term results, and the trial was only carried out at one institution, which might introduce selection bias. The evaluation did not include patient-reported outcomes and quality of life measures along with lacking subgroup analysis for various kinds of hip arthritis. Postoperative rehabilitation and surgical techniques and their impacts were not part of the investigation. Additional research needs to use a bigger patient sample across various medical centers while following patients' longer term to evaluate prosthesis longevity along with secondary complications. Evaluating patient-reported outcomes measures besides performing rehabilitation analysis would provide better insights into comprehensive hip arthroplasty outcomes. Proper subgroup analysis needs to evaluate separate types of hip arthritis in future research.

CONCLUSION

The research outcome identifies multiple long-term problems linked to hip arthroplasty which seriously diminish patient recovery by leading to implant loosening while causing functional reduction along with infections. The research results show that cemented implants generate superior survival outcomes but both types of prostheses present specific medical risks. The research showed that complications along with revisions in hip arthroplasty primarily stem from three factors: age combined with obesity and diabetes mellitus status. The research findings match current studies but study restrictions point toward future requirements for big multi-facility investigations and expanded endpoint evaluations to study hip arthroplasty outcomes.

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