

Functional outcome of total hip replacement in acetabular fractures

Abilash Simon Raj¹, Afwaan Faizal², Ajay Lucas Rubben Prabhu², Iffath Misbah²

¹Department of Orthopedics, Atlas Hospital Trichy, Tamil Nadu, India

²Department of Radio-diagnosis, Saveetha Medical College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India

ABSTRACT

Introduction. Total hip replacement (THR) has revolutionized the management of various hip pathologies, including acetabular fractures, which pose significant challenges due to their complex nature and debilitating effects. Acetabular fractures, resulting from high-energy trauma, present with severe pain and functional limitations, constituting a small percentage of all fractures worldwide. While THR offers promising outcomes, variability exists in functional improvement rates and postoperative complications.

Aim. This prospective observational study aims to estimate the functional outcomes and complications associated with THR in patients following acetabular fractures, with a focus on guiding clinical practice and optimizing patient care.

Methodology. The study included 30 patients undergoing THR after acetabular fractures or post-primary acetabular fixation. Surgical techniques involved the Kocher-Langenbeck approach and meticulous fracture management strategies. Clinical evaluation utilized the Harris Hip Score, while radiographic assessments monitored component positioning, stability, and osteolysis. Postoperative care included pain management and rehabilitation protocols.

Results. The majority of patients presented with segmental defects, with intraoperative bone grafting required in 87% of cases. Significant improvements in Harris Hip scores were observed postoperatively, indicating favorable functional outcomes. A majority of patients experienced good to excellent recovery, although postoperative complications such as pain, limping, and heterotrophic ossification were noted in some cases. Radiographic evaluations revealed satisfactory component positioning and long-term survival rates.

Conclusion. These findings support the role of THR in restoring functionality and improving the quality of life for affected individuals. Continued advancements and research efforts are crucial to further optimize outcomes in this challenging patient population.

Keywords: total hip replacement, acetabular fractures, functional outcomes, complications, Harris Hip Score

INTRODUCTION

Total hip replacement (THR) is a well-reputed surgical method that has significantly improved the quality of life for individuals suffering from various hip pathologies, including acetabular fractures. Acetabular fractures, which involve the socket part of the hip joint, can result from high-energy trauma like vehicle accidents or falls from height. These fractures often cause severe pain, disability, and functional limitations, making them challenging to manage effectively [1,2].

Acetabular fractures represent a relatively small proportion of all fractures, comprising approximately 3-5% of all fractures seen in trauma centres worldwide. These fractures typically occur in younger individuals with a bimodal age distribution, with one peak in young individuals due to high-energy trauma such as motor vehicle accidents and falls from height and another peak in elderly individuals due to low-energy mechanisms such as falls from standing height. The incidence of acetabular fractures varies across different regions and popula-

Corresponding author:
Ajay Lucas Rubben Prabhu
E-mail: mslucas007@gmail.com

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tions, with higher rates observed in urban areas and among individuals engaged in high-risk activities or occupations [1-3]. While precise epidemiological data on the functional outcomes of THR specifically in acetabular fracture cases may be limited, studies have reported variable success rates ranging from 70% to 90% in terms of pain relief and functional improvement following surgery [4]. Factors such as postoperative complications, implant-related issues, and residual hip dysfunction can impact the overall functional outcomes and long-term survivorship of THR in acetabular fracture patients. Therefore, further research focusing on larger cohorts with long-term follow-up is warranted to better elucidate the epidemiology and functional outcomes of THR in this challenging patient population [5,6].

The functional outcome of total hip replacement in acetabular fractures is a topic of significant clinical interest and research. Acetabular fractures can severely impair a person's capability to perform daily activities and lead to chronic pain and disability [7]. Total hip replacement offers the potential for restoring mobility, reducing pain, and improving the overall quality of life for these patients. Acetabular fractures can be complex and difficult to manage surgically. In some cases, traditional methods of fracture fixation may not be feasible or may result in suboptimal outcomes [5]. Total hip replacement provides an alternative treatment option, particularly in cases of severe comminution or displacement of the fracture fragments.

Assessing the long-term functional consequences of total hip replacement in acetabular fractures is crucial for understanding the durability and effectiveness of this surgical intervention. Studies evaluating factors such as pain relief, range of motion, return to pre-injury activity levels, and patient gratification provide valuable insights into the overall success of the procedure [8]. Research on the functional outcome of total hip replacement in acetabular fractures can contribute to the refinement of surgical techniques and implant designs [9]. By identifying factors associated with improved or compromised outcomes, clinicians can tailor their approach to enhance patient care and maximize treatment success rates.

Acetabular fractures are associated with substantial healthcare costs, including initial hospitalization, rehabilitation, and long-term follow-up care. Understanding the functional outcomes of total hip replacement in these patients is essential for optimizing resource allocation and healthcare utilization. Investigating the functional outcome of total hip replacement in acetabular fractures is critical for improving patient care, advancing surgical techniques, and optimizing healthcare resource utilization. By addressing these research questions, clini-

cians and researchers can further enhance the treatment options and outcomes of patients with acetabular fractures undergoing total hip replacement.

AIM

To guide clinical practice, optimize patient care, and ultimately improve the functional outcomes and quality of life for individuals undergoing THR following acetabular fractures.

METHODOLOGY

Study design: Prospective observational study.

Study subjects comprised 30 patients who underwent THR after acetabular fractures or post-primary acetabular fixation, at our hospital from 11/05/2021 to 04/06/2023.

Surgical technique

The choice of surgical approach is based on the location and severity of the acetabular fracture. The Kocher-Langenbeck approach is commonly utilized as it allows for simultaneous fracture fixation and total hip arthroplasty (THA), particularly facilitating the extension of fracture management anteriorly if needed. During the incision, positioning it slightly more superior and anteriorly enhances visualization. The gluteus maximus was cut from its femoral attachment, and care was taken to visualize and protect the sciatic nerve. Adequate exposure of the acetabulum is crucial, necessitating circumferential exposure. After femoral osteotomy, the final fitting broach was left in place, and the femur was anteriorly pushed with a curved retractor. Division of the gluteus minimus and reflected head of the rectus femoris facilitates displacement. Radial release of the inferior capsule and placement of an inferior retractor in the obturator foramen aid in identifying the transverse acetabular ligament. Intraoperative bony landmarks such as the subchondral bone in continuity with the ischium and the anteroinferior iliac spine were disrupted in most fracture types, guiding reduction and stabilization efforts. Reduction and stabilization of column fractures aim to correct major deformities, although anatomical reduction is not always necessary. Standard techniques such as pelvic reduction clamps and Schanz screws were employed to achieve stable fixation. Fixation, reaming, and grafting strategies depend on the severity and displacement of the fracture. Minimally displaced fractures required reaming and in situ grafting, while more complex cases necessitate mobilization, reduction, and fixation of fracture fragments before reaming. Trabecular metal augments or buttresses were used in cases of in-

adequate bone stock. Cup implantation and trial placement are guided by the diameter of the final reamer, ensuring adequate fixation with a minimum of four screws. Complex fractures may require major reconstruction techniques such as cage reconstruction or cup-cage constructs. Evaluation includes clinical findings assessed by the Harris Hip Score and serial follow-up X-rays for 2 years. The radiographic assessment encompasses the evaluation of the acetabular component position, loosening, periacetabular osteolysis, screw breakage, and migration. Postoperative care includes the administration of indomethacin to prevent heterotopic ossification, along with regular follow-up examinations at specific intervals up to two years. Clinical failure is defined as the need for acetabular revision for any reason, and survivorship analysis is conducted using the Kaplan-Meier test, with statistical analysis employing the Pearson or Fisher exact test.

RESULTS

Figure 1 shows that the majority of the patients had segmental defects (56%), (27%) had combined defects followed by cavity defects (17%).

Figure 2 shows that 87% of the study participants who underwent THR required bone graft intraoperatively.

Figure 3 illustrates the mean Harris Hip score in the study participants preoperatively (48.5) and postoperatively (91.5). It was seen that the mean change in the score was statistically significant with a p-value of 0.000.

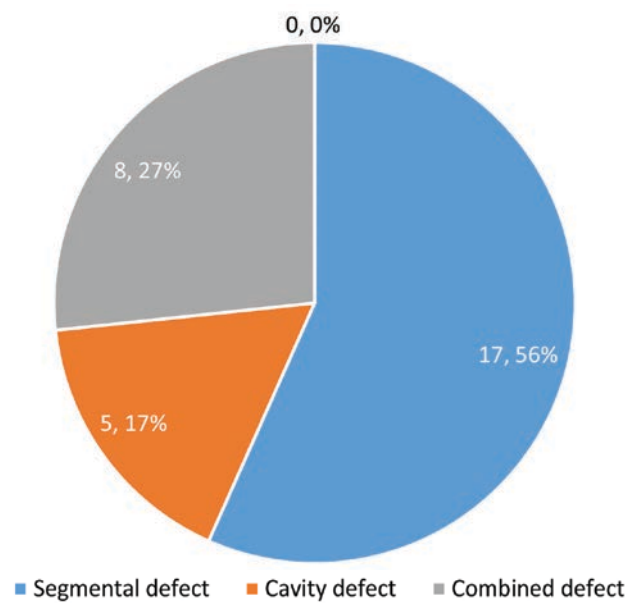


FIGURE 1. Type of defect in study participants

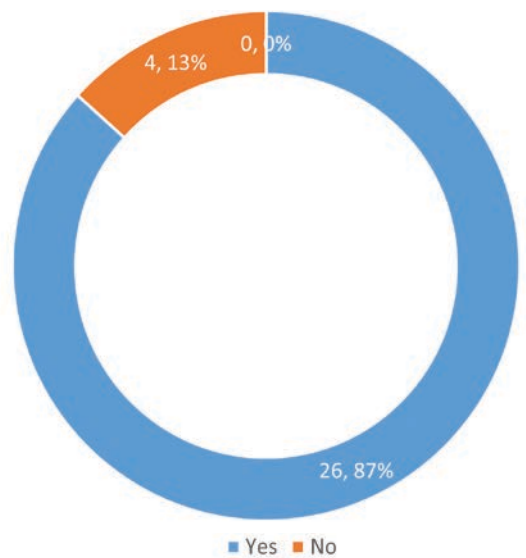
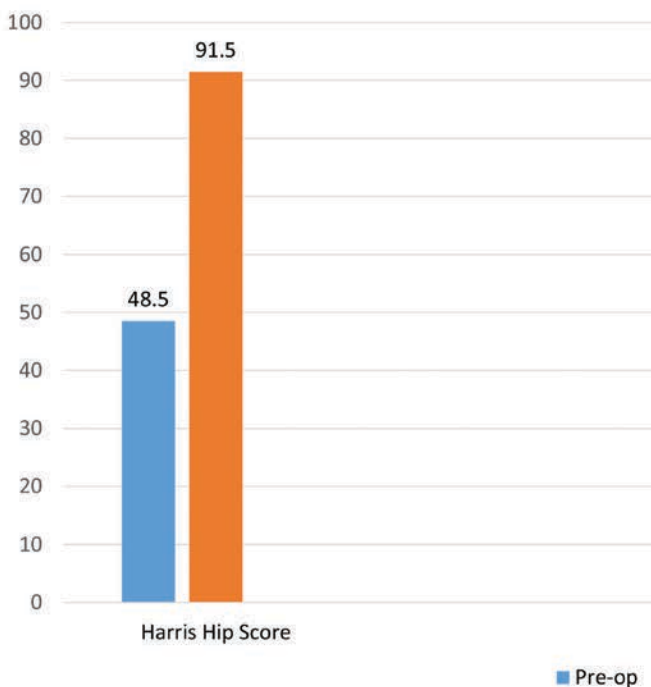


FIGURE 2. Intraoperative bone graft requirement in the study participants



p = 0.000

FIGURE 3. Harris hip score in the study participants

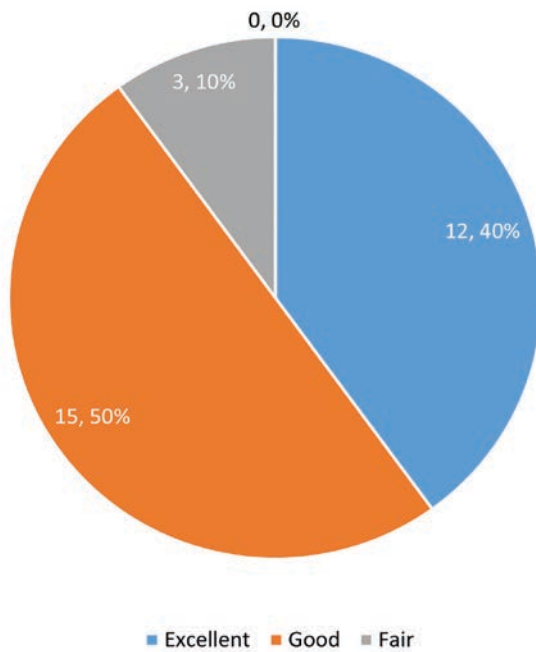


FIGURE 4. Postoperative results in the study participants

50% of the patients had a good recovery postoperatively, 40% had an excellent recovery and a minor 10% had a fair recovery postoperatively as seen in Figure 4.

Table 1 presents the postoperative complications observed in the study participants undergoing total hip replacement for acetabular fractures. Among the total 30 participants, the majority (66.7%) reported no pain postoperatively, while 13.3% experienced moderate pain and 20% reported severe pain. Regarding mobility, 36.7% of participants exhibited a limp postoperatively, while the majority (63.3%) showed no signs of limping. The Trendelenburg sign, indicative of weakness in the hip abductor muscles, was present in only 6.7% of participants, with 93.3% showing no signs of this sign. Heterotrophic ossification, characterized by abnormal bone formation at the surgical site, was observed in 16.7% of participants, while the remaining 83.3% did not develop this complication. Overall, the table provides insights into the prevalence of various postoperative complications following total hip replacement in acetabular fracture cases, highlighting the need for comprehensive management strategies to address these issues and optimize patient outcomes.

Additional findings include: The mean abduction angle of the acetabular component was 37.8° (range: 26-52°), with all cups exhibiting anteversion. In comparison to normal hips, the reconstructed hip centre was positioned within 10mm of vertical and horizontal symmetry, effectively restoring anatomical joint centre alignment. Partial radiolucency was observed in two hips (zones 2 and 3), both of which maintained favourable Harris hip scores. Notably, no radiolucen-

TABLE 1. Postoperative complications in the study participants

Complication	Total no of participants n=30 (%)
Pain	
No	20 (66.7)
Moderate pain	4 (13.3)
Severe	6 (20)
Limp	
Present	11 (36.7)
Absent	19 (63.3)
Trendelenburg sign	
Present	2 (6.7)
Absent	28 (93.3)
Heterotrophic ossification	
Yes	5 (16.7)
No	25 (83.3)

cy was detected around the femoral stem, and there were no instances of acetabular screw breakage or migration. Additionally, none of the components displayed marginal, retro acetabular, or screw-related osteolysis, and there was no evidence of acetabular cup migration. The Kaplan-Meier 5-year survival rate reached 100%, with a confidence interval of 95%-100%.

DISCUSSION

The results of this study provide valuable insights into the functional outcomes and complications associated with total hip replacement (THR) in patients with acetabular fractures. Figure 1 demonstrates that segmental defects were the most common type of defect observed in study participants, followed by combined defects and cavity defects. These findings underscore the diverse nature of acetabular fractures and highlight the importance of individualized treatment approaches to address specific fracture patterns. Figure 2 reveals a high prevalence of intraoperative bone graft requirement, emphasizing the significance of addressing bone loss and ensuring adequate bone stock during THR procedures in acetabular fracture cases.

Figure 3 illustrates a significant improvement in mean Harris Hip scores from preoperative to postoperative assessments, indicating favourable functional outcomes following THR. The substantial increase in Harris Hip scores underscores the effectiveness of THR in restoring hip function and enhancing quality of life for patients with acetabular fractures. Figure 4 further corroborates these findings by demonstrating that a majority of patients experienced good to excellent recovery postoperatively, highlighting the overall success of THR in this patient population. Additionally, Table 1 provides insights into the prevalence of postoperative complications following THR for acetabular fractures. While the majority of patients reported no

pain postoperatively, a notable proportion experienced moderate to severe pain, emphasizing the importance of adequate pain management strategies in the postoperative period. Similarly, the occurrence of limping and Trendelenburg sign in a subset of patients underscores the need for comprehensive rehabilitation protocols to optimize functional outcomes.

Furthermore, the absence of acetabular screw breakage, migration, and osteolysis, as well as the high survival rate of THR components, as indicated by the Kaplan-Meier analysis, reflects the durability and long-term success of THR in acetabular fracture cases. These findings contribute to our understanding of the safety and efficacy of THR as a treatment modality for acetabular fractures, informing clinical decision-making and guiding future research directions in this field.

Acetabular fractures present significant technical challenges and are associated with substantial morbidity. Restoration of joint congruency is paramount in achieving successful outcomes, particularly in cases of failed acetabular fractures where total hip replacement (THR) is a complex procedure requiring meticulous preoperative planning. Primary THR may be considered in fresh acetabular fractures where long-term durability cannot be assured. Research indicates favourable outcomes with cementless acetabular fixation, as demonstrated by Ranawat's study showing significant improvements in Harris hip scores postoperatively. However, sclerotic acetabular beds post-fracture may lead to inconsistent cement penetration, increasing the risk of early cup loosening. Patients with previous open reduction and internal fixation (ORIF) pose additional challenges to THR, with considerations including scar tissue, excision of heterotrophic bone, and retaining hardware. While differences between ORIF and non-ORIF in terms of loosening and clinical outcomes are minimal, extensive pelvic dissection may contribute to acetabular bone osteonecrosis [10].

Younger patients generally exhibit better clinical outcomes, although increased rates of aseptic loosening and osteolysis are observed in those under 60 years old. Suboptimal cup placement may result from abnormal acetabular anatomy, necessitating careful consideration during surgery. Novel techniques such as CT-guided screw insertions and custom-made cups with clustering screw holes show promise in maximizing surgical outcomes. THA following acetabular fractures carries a higher risk of infection, especially in patients with multiple previous surgeries or hardware. Intraoperative complications include iatrogenic nerve injuries and periprosthetic femoral fractures, while common postoperative complications include heterotrophic

ossification and hip dislocation. Salvage procedures like THA may be necessary for femoral head collapse and osteonecrosis, particularly in non-ORIF patients. Operative time and blood loss do not significantly impact final Harris hip scores, with bone grafts playing a crucial role in defect reconstruction.

Ortega-Briones et al. in their study [11] *Out of the initial cohort*, 14 hips were included in the assessment, with 9 patients having passed away and 2 lost to follow-up. There were no reported complications beyond the perioperative phase, and both clinically and on the most recent radiographs, no signs of loosening were observed in any acetabular components. The mean Harris Hip Score among the evaluated hips was 92, comparable to our study. In another study by Kumar et al. [12] the mean HHS of the patients was 84.3 with a range from 56 to 100, similar to our study.

Hanschenet et al. [13] report while open reduction and internal fixation (ORIF) are typically regarded as the conventional treatment approach for acetabular fractures, elderly patients may experience elevated rates of treatment failure. Acute total hip replacement (THR) has demonstrated the potential to yield favourable results in such cases. However, achieving satisfactory outcomes hinges on several factors, including a comprehensive grasp of the fracture pattern, a meticulous evaluation of patient risk factors and prognostic indicators, and the selection of an appropriate implant tailored to the specific fracture scenario.

Daurka et al. [14] reported the average incidence of non-fatal complications stood at 39.8% (ranging from 0% to 64%), while the mean mortality rate was 19.1% (ranging from 5% to 50%), observed over an average period of 64 months which was discordant from our study findings. Kumar et al. [15] reported the mean acetabular angle of 46.3° and the mean centre-edge angle was 15.4° in line with our study. Another study by Siwach et al [16] showed mean Harris Hip score was 83.5.

Lee et al. [177] showed that complications encompassed 11 instances of dislocation (6.1%), ten occurrences of periprosthetic fractures (5.5%), two cases of deep infections (1.1%), four incidents of sciatic nerve palsies (2.2%, with three resolving without intervention and one showing improvement after exploration and adhesion release), and one vascular injury (0.6%). Before surgery, the mean modified Harris Hip Score was 41 (ranging from 10 to 82), while postoperatively at one year, it reached 77 (ranging from 39 to 93), maintaining the same level at 77 (ranging from 38 to 93). The findings of this study did not align with our study.

Despite satisfactory outcomes, prospective studies comparing acute and delayed THA in acetabular fractures are lacking, highlighting the need for fur-

ther research to assess reconstruction longevity. Limitations of this study comprise a small sample size and brief follow-up duration.

CONCLUSION

Despite the inherent technical challenges associated with the procedure, total hip arthroplasty (THA) in patients who have had prior unsuccessful treatments for acetabular fractures yields promising outcomes. The approach demonstrates a mini-

mal complication rate alongside a notable degree of patient contentment. These encouraging results underscore the efficacy of THA as a viable treatment option for addressing the complexities of acetabular fractures, emphasizing its role in restoring functionality and enhancing the quality of life for affected individuals. Continued advancements in surgical techniques and implant technologies hold the potential to further refine outcomes and expand the scope of successful interventions in this challenging patient population.

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