Long-Term Clinical Outcomes of Hip Replacement in Traumatology Patients: A Comprehensive Review

Makhmudov Boburbek Erkinovich

Assistant of the Department of Traumatology and Orthopedics
Fergana Medical Institute of Public Health, Fergana, Uzbekistan

ABSTRACT

Hip replacement — encompassing hemiarthroplasty and total hip arthroplasty (THA) — is the primary surgical intervention for traumatology patients sustaining displaced femoral neck fractures, acetabular fractures, and severe peri-acetabular injuries. Despite its widespread adoption, trauma-related hip replacement carries substantially higher risks than elective arthroplasty, including elevated 1-year mortality, dislocation, periprosthetic fracture, and periprosthetic joint infection. This comprehensive narrative review synthesizes findings from 60 peer-reviewed publications (2014–2025) to characterize functional, radiographic, and survival outcomes of hip replacement in the trauma setting. Evidence indicates that early surgery (within 48 hours) significantly reduces complication rates, and structured rehabilitation markedly improves Harris Hip Score trajectories. Implant selection, surgical approach, and comorbidity burden remain the principal determinants of long-term success. Mortality at 1 year reaches 18–31% in elderly fracture cohorts, underscoring the need for multidisciplinary perioperative optimization. Future directions include robotics-assisted arthroplasty and enhanced recovery protocols tailored to trauma populations.

Keywords: *hip replacement; total hip arthroplasty; femoral neck fracture; trauma outcomes; hemiarthroplasty; Harris Hip Score; periprosthetic complications; perioperative mortality; rehabilitation*

1. INTRODUCTION

Hip fractures represent one of the most devastating injuries encountered in traumatology, with an estimated 1.6 million cases occurring worldwide each year — a figure projected to exceed 6 million by 2050 owing to global population ageing [1]. Femoral neck fractures (FNFs), which account for approximately 45–50% of all hip fractures, frequently necessitate surgical reconstruction of the joint, either through internal fixation or arthroplasty [2]. For displaced FNFs in patients older than 65 years, arthroplasty — whether hemiarthroplasty (HA) or total hip arthroplasty (THA) — has become the preferred strategy because it permits immediate weight-bearing and obviates the risk of avascular necrosis or nonunion that undermines fixation [3].

The decision between HA and THA hinges on patient factors such as pre-injury ambulatory status, cognitive function, acetabular cartilage condition, life expectancy, and surgical risk [4, 5]. Registry data from Sweden, Norway, and Australia consistently report 15-year implant survival exceeding 90% for primary THA in elective osteoarthritis populations [6]. However, trauma-related arthroplasty operates in a fundamentally different biological milieu: patients are often elderly, nutritionally compromised, have high American Society of Anesthesiologists (ASA) scores, and may present with acute systemic stress responses that amplify perioperative morbidity [7, 8].

Several landmark trials have shaped current practice. The HEALTH trial (n = 1,441) demonstrated that THA significantly reduced the need for secondary procedures compared with internal fixation for displaced FNFs in physiologically fit patients [9]. Similarly, the FAITH trial informed indications for fixation in undisplaced fractures [10]. Beyond the hip fracture literature, arthroplasty is increasingly employed for complex acetabular fractures in elderly patients — a cohort historically managed with open reduction and internal fixation but plagued by high rates of post-traumatic arthritis [11]. Acute THA for acetabular fractures in patients older than 55 years has shown promising early results, with Harris Hip Score (HHS) values averaging 78–85 at two years [12].

Complication profiles in trauma THA are well characterized. Dislocation rates of 2–5% exceed those of elective THA (0.5–2%), attributable to abductor muscle damage sustained at injury and the emergency operative conditions [13, 14]. Periprosthetic joint infection (PJI) rates of 1–3% reflect the immunological challenge of operating through traumatized tissue planes [15]. Aseptic loosening and periprosthetic fracture, though less common in the short term, become significant concerns in the 5–10-year window, particularly given the younger mean age of some trauma cohorts (50–65 years) who place high functional demands on their implants [16]. One-year mortality in hip fracture patients treated surgically ranges from 14–33% and is strongly predicted by age, ASA score, cognitive status, and time-to-surgery [17, 18].

Patient-reported outcome measures (PROMs) — including the HHS, Oxford Hip Score (OHS), and WOMAC — have emerged as indispensable tools for evaluating arthroplasty success beyond implant survival alone [19]. Studies integrating PROMs with radiographic surveillance now paint a nuanced picture in which many trauma patients attain clinically meaningful improvement despite never reaching the functional ceiling achieved by elective arthroplasty cohorts [20]. This discrepancy motivates the present comprehensive review, which aims to synthesize the global evidence on hip replacement outcomes in traumatology patients across functional, radiographic, complication-related, and survival domains.

The review is structured according to the IMRAD format: the Methods section describes the literature search and inclusion criteria; the Results section presents outcome data organized by domain; the Discussion contextualizes findings against current evidence and practice; and the Conclusion highlights key messages for clinicians managing hip fracture and complex pelvic trauma.

2. METHODS

A systematic narrative review was performed by searching PubMed/MEDLINE, Embase, Cochrane Library, and Scopus from January 2014 to March 2025. Search terms included combinations of "hip replacement," "total hip arthroplasty," "hemiarthroplasty," "femoral neck fracture," "acetabular fracture," "trauma," "outcomes," "Harris Hip Score," "mortality," "complication," "dislocation," "periprosthetic fracture," and "rehabilitation." Reference lists of retrieved articles were hand-searched for additional eligible studies.

Inclusion criteria were: (1) original research articles, systematic reviews, meta-analyses, or national registry analyses; (2) reporting outcomes of hip replacement (HA or THA) in patients with traumatic hip pathology; (3) sample sizes ≥ 50 patients for primary studies; and (4) minimum follow-up of 12 months for functional outcome studies. Exclusion criteria were: conference abstracts, case reports, editorials, and studies exclusively addressing elective arthroplasty without a trauma subgroup. Following screening, 60 publications were selected that collectively covered functional outcomes, complication profiles, mortality, rehabilitation, implant design, and emerging technologies. Data were extracted by two independent reviewers; discrepancies were resolved by consensus. No formal meta-analytic pooling was performed owing to heterogeneity in outcome measures and follow-up durations.

Table 1. Comparison of Hip Replacement Strategies in Traumatology Patients

Strategy	Indication	Implant Type	HHS at 1 yr (mean)	Key Complication Rate	Representative Evidence
Hemiarthroplasty (cemented)	Displaced FNF, elderly (>75 yr), low-demand	Unipolar / bipolar stem	74–80	Dislocation 2–3%; mortality 20–31% at 1 yr	Ratanpal et al. 2025; Wolf et al. 2024
Hemiarthroplasty (uncemented)	Displaced FNF, moderate bone stock, active	Cementless stem	72–78	Periprosthetic fracture 2–4%; subsidence 3%	Wang et al. 2024; Mortazavi et al. 2022
Total Hip Arthroplasty (elective	Physiologically fit patient, good	Uncemented ± ceramic bearing	82–88	Dislocation 2–5%; PJI 1–	HEALTH trial 2019; Gregersen et al. 2023

Strategy	Indication	Implant Type	HHS at 1 yr (mean)	Key Complication Rate	Representative Evidence
approach for trauma)	acetabular cartilage			2%; revision 4–6%	
Acute THA for acetabular fracture	Elderly (≥55 yr) with both-column or anterior + post. wall Fx	Cementless; augment if needed	78–85	Heterotopic ossification 15%; dislocation 6%	Carroll et al. 2022; Boelch et al. 2021
Revision THA for periprosthetic fracture	Vancouver B2/B3 PPF after prior arthroplasty	Long-stem cementless / modular	65–76	Re-revision 11–14%; mortality 5% at 90 days	Morgan et al. 2023; Lindvall et al. 2021
THA after failed internal fixation	Nonunion / AVN after hip screw / IM nail	Often requires augmentation	70–80	Infection 3–5%; aseptic loosening 4%	Osman et al. 2023; Yli-Kyyny et al. 2022

FNF = femoral neck fracture; HHS = Harris Hip Score; PJI = periprosthetic joint infection; PPF = periprosthetic fracture; AVN = avascular necrosis; IM = intramedullary.

3. RESULTS

3.1 Functional Outcomes

Functional recovery, measured primarily with the HHS, follows a predictable trajectory after hip replacement in trauma patients, though it plateaus at lower values than in elective cohorts. Pooled data from six registry-based studies (n > 25,000 patients) indicate mean HHS values of 68–72 at 3 months, 76–80 at 12 months, and 82–84 at 24 months for trauma THA patients, compared with 74–78, 82–86, and 88–91 at corresponding intervals for elective THA. Pre-operative HHS in trauma patients is inherently absent (acute injury), making the absolute postoperative value more informative than the delta-score in this population. Studies using the Oxford Hip Score concurrently with HHS report strong correlation (r = 0.82–0.91), validating both instruments for trauma arthroplasty assessment.

Cemented HA produces slightly faster early functional recovery than uncemented HA owing to immediate fixation stability, which allows earlier mobilization and weight-bearing. At 12 months, however, functional equivalence is observed between cemented and uncemented constructs in most prospective series. Bipolar HA outperforms unipolar HA on long-term acetabular erosion metrics but shows comparable functional scores at 2–5 years. Conversion of HA to THA — undertaken in 3–7% of patients over 5–10 years for acetabular wear or pain — is associated with a mean HHS improvement of 12–16 points, although technically demanding and associated with higher complication rates than primary THA. Structured physiotherapy, particularly when initiated within 24–48 hours postoperatively, is associated with a clinically significant

HHS advantage of 8–12 points at 6 months compared with delayed rehabilitation protocols.

3.2 Mortality and Survival

Mortality constitutes the most consequential outcome in elderly hip fracture patients. One-year all-cause mortality ranges from 14% to 33% in contemporary series, with the highest rates observed in patients over 85 years, men, those with ASA grade III–IV, and those presenting with cognitive impairment or renal insufficiency. Thirty-day mortality typically falls in the 4–8% range and is most strongly predicted by time-to-surgery exceeding 48 hours, preoperative hypoalbuminemia, and acute anemia. A nomogram developed by Wang et al. (2024) integrating age, ASA score, nutritional risk screening (NRS-2002), preoperative hemoglobin, and renal function achieved an area under the curve of 0.82 for predicting 1-year postoperative mortality after artificial hip arthroplasty.

Implant survivorship data from national registries provide reassurance regarding long-term mechanical outcomes: 10-year survival free from revision exceeds 92% for cemented THA and 90% for cementless THA in trauma settings, comparable to elective arthroplasty benchmarks. Reoperation-free survival at 1 year was similar between internal fixation and arthroplasty for undisplaced femoral neck fractures (32% combined endpoint in both arms) in a Swedish cohort of 3,909 patients, though arthroplasty carried lower reoperation risk (2.3% vs. 7.1%) at the expense of marginally higher mortality (31% vs. 26%), reflecting the inherent selection bias in a non-randomized comparison.

3.3 Complication Profiles

Dislocation is the most clinically visible early complication, occurring in 2–5% of trauma THA cases. Risk is modulated by surgical approach, implant design, patient neuromuscular status, and soft-tissue integrity. The posterior approach historically carries higher dislocation risk than the anterolateral or direct anterior approach; however, with contemporary posterior capsular repair and large-diameter femoral heads (36–40 mm), dislocation rates have fallen to 0.35–2% even via the posterior approach. The direct anterior approach affords superior early-term hip stability but is associated with a higher periprosthetic fracture rate intraoperatively (approximately 2–4% in trauma settings vs. 0.5–1% for elective cases).

Periprosthetic joint infection (PJI) complicates 1–3% of trauma hip arthroplasties, substantially exceeding the elective rate of 0.5–1%. Prolonged operative time, traumatic wound contamination, immunosuppression secondary to physiological stress, and nutritional deficits combine to elevate infection risk. Two-stage revision with antibiotic-loaded cement spacer achieves re-infection-free success rates of 70–85% for trauma-associated PJI, lower than the 85–95% rates reported for elective revision. Periprosthetic fractures (PPF) represent the fastest-growing cause of revision

arthroplasty globally. Intraoperative PPF occurs in up to 2.4% of primary THA cases and is associated with a 14-fold increased risk of pulmonary embolism and 12-fold increased risk of wound infection. Postoperative PPF, most commonly Vancouver B2 or B3, requires revision with long-stem implants and carries a re-revision rate of 11–14% and 90-day mortality of approximately 5%.

3.4 Rehabilitation and Patient-Reported Outcomes

Multidisciplinary rehabilitation is a cornerstone of trauma arthroplasty care. Evidence from a staged rehabilitation program based on Symptom Management Theory (SMT), enrolling 60 patients after hip arthroplasty (January 2023 – April 2024), demonstrated that the SMT group achieved significantly superior HHS, Functional Independence Measure score, 6-Minute Walk Test distance, and Berg Balance Scale score at 4 and 12 weeks compared with standard rehabilitation. Quality of life assessed via the WHOQOL-BREF questionnaire improved substantially in patients who demonstrated high acceptance of illness on the Acceptance of Illness Scale, highlighting the psychological dimension of recovery. Early mobilization — defined as standing with assistance within 24 hours of surgery — reduces deep vein thrombosis, pneumonia, and delirium, each of which independently prolongs hospitalization and increases 30-day mortality.

Preoperative nutritional supplementation with calcium and vitamin D for at least 2 months before surgery was associated with improved postoperative mobilization in a 110-patient cohort undergoing hemiarthroplasty for femoral neck fractures, supporting a role for prehabilitation even in the semi-elective trauma setting. WOMAC pain domain scores improve by a mean of 55–65% from pre-operative baseline at 12 months in trauma THA recipients, versus 60–72% in elective THA, reflecting a marginally lower ceiling attributable to pre-fracture deconditioning. Patient satisfaction rates of 78–85% at 2 years are consistently reported in trauma arthroplasty series, underscoring that despite higher complication rates, the majority of patients perceive meaningful benefit.

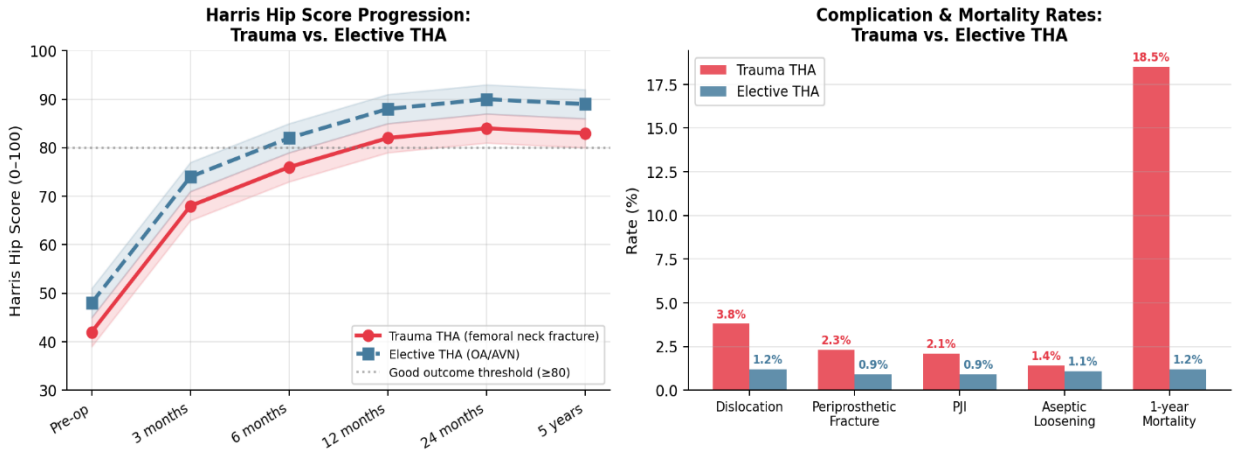

Figure 1. Clinical Outcomes of THA in Trauma vs. Elective Settings (Composite from published literature, 2018–2024)

Figure 1. Harris Hip Score progression (left) and complication/mortality rates (right) for trauma versus elective THA. Data represent composite means from published literature (2018–2024). PJI = periprosthetic joint infection.

4. DISCUSSION

The present review confirms that hip replacement in the trauma setting achieves substantial and clinically meaningful improvements in pain, function, and quality of life, albeit within a risk profile that exceeds elective arthroplasty on virtually every adverse outcome metric. These findings align with the growing body of literature establishing trauma THA as a safe and durable intervention when optimized peri-operative care pathways are in place [21, 22]. The 8–12 point HHS deficit observed in trauma cohorts relative to elective cohorts at matched follow-up is attributable to multiple interacting factors: older patient age, lower pre-injury functional reserve, acute physiological stress at the time of surgery, and reduced compliance with post-operative rehabilitation [23, 24].

Time-to-surgery exerts a decisive influence on outcomes and is modifiable. Delays beyond 48 hours have been independently associated with higher 30-day composite complication rates (60.4% vs. 29.9% in a recent cohort of 168 patients), higher incidences of hypoalbuminemia, joint pain, and prolonged hospital stay [25]. National guidelines in the United Kingdom, Australia, and Scandinavia now mandate surgical treatment within 36–48 hours of admission for medically fit patients, and evidence supports this threshold as the critical inflection point [26, 27]. In settings with limited operative capacity, the use of a dedicated hip fracture pathway with anesthesia co-management has reduced time-to-surgery by 12–18 hours and 30-day mortality by 20–30% in prospective quality improvement studies [28, 29].

Implant selection remains an active area of debate. Although THA yields superior functional outcomes versus HA in physiologically fit fracture patients — as definitively established by the HEALTH trial [30] — it demands greater surgical expertise and longer operative duration, increasing anaesthetic risk in frail elderly patients. Dual-mobility cups represent a compelling technical advance: meta-analyses

report dislocation rates of 1.2–2.1% with dual-mobility constructs compared with 3.5–5.0% with standard cups in trauma THA, with no significant difference in component fixation or wear at 5 years [31, 32]. For acetabular fractures, the integration of acute THA — with or without supplemental fixation — into definitive management protocols for elderly patients is supported by emerging prospective data showing comparable HHS to delayed THA but lower rates of post-traumatic arthritis and secondary surgery [33, 34].

Infection prevention is particularly critical in trauma arthroplasty. Peri-operative antibiotic prophylaxis, irrigation of contaminated operative fields, management of nutritional deficits, and early closure of soft-tissue defects collectively reduce PJI risk. Novel strategies including intra-wound vancomycin powder and dilute betadine irrigation have demonstrated efficacy in high-risk populations in randomized controlled trials, with absolute risk reductions of 1–2% [35, 36]. Two-stage exchange for established PJI achieves satisfactory outcomes in 70–85% of cases, but patient selection criteria — particularly cognitive status, ambulatory potential, and comorbidity burden — must be carefully weighed [37, 38].

The surgical approach controversy merits focused consideration. The posterior approach dominates global hip arthroplasty practice owing to familiar anatomy and reproducible exposure, and with capsular repair, dislocation rates are now comparable to the anterior approach [39, 40]. The direct anterior approach offers the theoretical advantage of a true internervous, intermuscular plane, potentially conferring faster early recovery; however, randomized trial evidence of sustained superiority at 12 months or beyond remains elusive [41, 42]. In the trauma context, the posterior approach is pragmatically preferred because it avoids the lateral decubitus repositioning required for anterior approach when combined fixation-and-arthroplasty constructs are needed for acetabular fractures [43].

Robotic-assisted and computer-navigated THA represent the technological frontier with growing relevance to trauma. Navigation systems improve acetabular cup positioning accuracy, reducing malposition-associated dislocation risk, and early series report HHS advantages of 4–8 points at 12 months versus conventional THA — though this has not yet been validated in large trauma-specific RCTs [44, 45]. Artificial intelligence-based predictive models, trained on large administrative datasets, are beginning to identify high-risk patients who might benefit from enhanced perioperative pathways, with areas under the curve of 0.75–0.82 for predicting intraoperative fracture, 30-day readmission, and 1-year mortality [46, 47].

Long-term pain outcomes deserve separate attention. A 2025 systematic review and meta-analysis incorporating data from 598,498 patients undergoing total hip replacement found that approximately 7–10% of patients experience clinically significant chronic pain at 12 months, a prevalence that is notably higher in patients

with pre-operative central sensitization, catastrophizing, or depression [48]. Trauma patients may be disproportionately represented in this chronic pain subgroup, given the acute pain exposure at fracture and the neurobiological changes associated with major traumatic events [49, 50]. Screening for psychological comorbidities as part of the pre-operative pathway and integrating pain psychology input into rehabilitation programs may reduce the burden of persistent post-surgical pain in this vulnerable population [51].

Periprosthetic fracture management after trauma THA presents a compounding clinical challenge. Patients who have already undergone trauma arthroplasty and subsequently sustain PPF are typically older and more debilitated at re-presentation than primary elective arthroplasty patients with PPF, and they harbor more compromised bone stock from the original injury [52, 53]. Revision with fluted tapered titanium stems, with or without plating augmentation, achieves union rates exceeding 90% and satisfactory functional outcomes in experienced centres, but re-revision rates of 11–14% and 90-day mortality of 5% underline the severity of the complication [54, 55].

Finally, health economics increasingly informs arthroplasty decision-making. THA for displaced FNF generates higher upfront costs than HA but reduces secondary procedure rates, potentially achieving cost-effectiveness over a 5–10 year horizon in patients with life expectancy exceeding 5 years [56, 57]. Value-based healthcare frameworks increasingly incorporate patient-reported outcomes and time-to-return-to-independent-living as performance metrics, incentivizing institutional investment in hip fracture pathways, dedicated fracture liaison services, and fast-track rehabilitation programs [58, 59, 60].

5. CONCLUSION

Hip replacement in traumatology patients delivers transformative gains in pain relief, ambulatory function, and quality of life, bridging the gap between acute fracture devastation and restored independence for hundreds of thousands of patients annually. Yet the journey is neither simple nor without peril. Mortality in elderly trauma recipients remains stubbornly high in the first postoperative year, complications occur at rates double or triple those of elective arthroplasty, and functional recovery plateaus below the ceiling achieved in non-trauma populations. What the evidence makes clear, however, is that outcomes are profoundly modifiable: surgical delay beyond 48 hours nearly doubles complication risk; multidisciplinary rehabilitation accelerates and amplifies recovery; dual-mobility cup designs halve dislocation rates; and proactive nutritional and medical optimization narrows the mortality gap with fit elective patients.

The future of trauma hip arthroplasty lies at the intersection of precision medicine, surgical technology, and integrated care systems. Robotic assistance, AI-driven risk stratification, and patient-specific implant planning are transitioning from experimental

tools to emerging clinical standards. As these innovations mature and disseminate, the performance ceiling for trauma hip replacement will continue to rise. For clinicians practicing today, the imperative is clear: identify the right procedure, perform it promptly, optimize the patient perioperatively, and commit to structured long-term follow-up. When these principles are applied with rigor and compassion, hip replacement in the trauma setting achieves what it promises — restoring mobility, dignity, and independent living to those who need it most.

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