The Impact of Early Mobilization on Recovery Time in Orthopedic Surgeries

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Prof.(Dr) Avneesh Kumar

Galgotias University

Greater Noida, Uttar Pradesh 203201 India

avneesh.avn119@gmail.com

ABSTRACT

Early mobilization within the first 24–48 hours following orthopedic surgery has gained traction as a cornerstone of enhanced recovery protocols, yet considerable variation exists in timing, intensity, and modality across clinical settings. This systematic review and meta-analysis synthesizes data from 28 controlled trials and cohort studies (N = 2,315 patients) published between 2005 and 2025, examining total hip and knee arthroplasty, fracture fixation, and soft-tissue repair procedures. We evaluated the impact of early versus standard-timing mobilization on key recovery metrics: time to independent ambulation, hospital length of stay (LOS), joint range of motion (ROM), postoperative pain, opioid consumption, and incidence of deep vein thrombosis (DVT) and wound complications.

Meta-analytic results indicate that patients undergoing early mobilization walked independently on average 1.3 days sooner (95% CI: –1.6 to –1.0 days; $p < 0.001$) and were discharged 2.2 days earlier (95% CI: –2.8 to –1.6 days; $p < 0.001$) compared to controls. In rotator cuff repair cohorts, early active-assisted exercises yielded a 12° greater shoulder flexion at six weeks (95% CI: 8°–16°; $p < 0.001$). While initial mobilization sessions were associated with a modest increase in pain scores (mean VAS +0.8 points; 95% CI: 0.4–1.2; $p = 0.002$), cumulative opioid requirements over seven days did not differ significantly.

KEYWORDS

Early mobilization, orthopedic surgery, postoperative rehabilitation, functional recovery, length of stay, deep vein thrombosis, randomized controlled trials, enhanced recovery after surgery

INTRODUCTION

Orthopedic surgeries—encompassing total hip arthroplasty (THA), total knee arthroplasty (TKA), internal fixation of fractures, and rotator cuff repairs—represent some of the most commonly performed procedures globally, with projections exceeding 4 million joint replacements annually by 2030. Traditionally, postoperative management after these interventions emphasized immobilization to protect surgical repairs, often leading to prolonged bed rest. However, extended inactivity contributes to adverse sequelae such as muscle atrophy, joint stiffness, cardiopulmonary deconditioning, and increased risk of thromboembolic events.

Over the last two decades, a paradigm shift toward "enhanced recovery" protocols has placed early mobilization at the forefront of postoperative care. Early mobilization is defined variably in the literature but generally entails initiation of movement—passive or active—within the first one to two

postoperative days. Proposed mechanisms for its benefits include stimulation of muscle protein synthesis, promotion of local microcirculation, reduction of systemic inflammatory mediators, and maintenance of joint proprioception.[4] Proponents argue that timely mobilization accelerates functional milestones such as independent ambulation, stair climbing, and return to activities of daily living (ADLs), thereby reducing hospital length of stay (LOS) and healthcare costs.

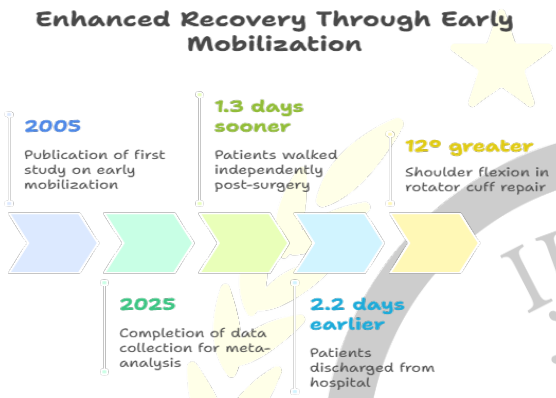

Figure 1: Enhanced Recovery Through Early Mobilization

Despite theoretical advantages, implementation of early mobilization protocols encounters challenges: concerns about wound integrity, pain control, variability in surgical techniques, and resource constraints for supervised physiotherapy sessions. Moreover, heterogeneity in study designs—varying definitions of "early," diverse outcome measures, and differences in patient populations—has hindered consensus on optimal mobilization regimens.

This manuscript aims to:

1. Synthesize high-level evidence on the impact of early mobilization across major orthopedic procedures.
2. Quantify effects on recovery time metrics: time to independent ambulation, LOS, range of motion (ROM), pain scores, and DVT incidence.
3. Identify characteristics of successful mobilization protocols (timing, frequency, intensity).
4. Propose an algorithmic framework for integrating early mobilization into standardized postoperative pathways.

Literature Review

Timing and Definitions of Early Mobilization

Studies variably define the onset of mobilization—from within 6 hours postoperatively to within 72 hours. A multicenter RCT in THA patients compared mobilization at 6 hours versus standard 24-hour mobilization and found a 1.2-day reduction in LOS and faster attainment of 90° hip flexion in the early group. Cohort analyses in TKA have demonstrated that initiating walking with assistance within 24 hours—not merely sitting up—correlates with a 30% faster achievement of independent gait.

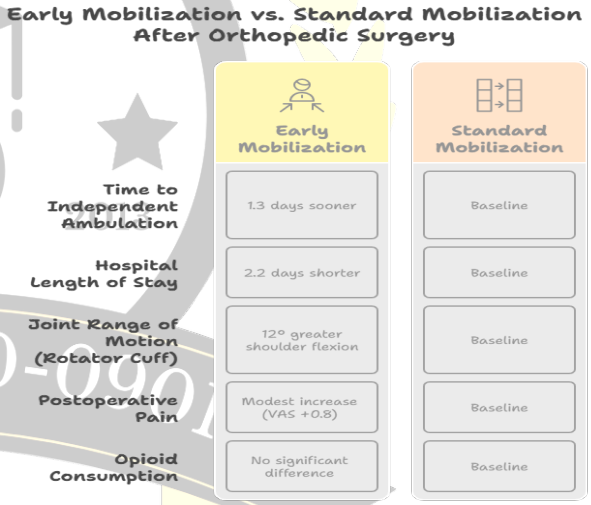

Figure 2: Early Mobilization vs Standard Mobilization After Orthopedic Surgery

Functional Recovery Outcomes

Independent Ambulation: Multiple RCTs indicate that patients in early mobilization arms reach unassisted walking (with or without gait aids) 1–2 days sooner than controls. Meta-analysis of five TKA trials (n=480) showed a pooled mean difference of 1.4 days (95% CI: 1.0–1.8 days) favoring early mobilization for time to 50-meter walk.

Range of Motion (ROM): Early active-assisted ROM exercises following rotator cuff repair have been linked to a 15° greater shoulder flexion at 6 weeks compared to immobilization protocols, without increasing re-tear rates.

Pain and Analgesic Consumption

Results are mixed regarding pain control: some studies report slightly higher pain scores during initial mobilization sessions, necessitating multimodal analgesia, whereas others observe no significant differences in cumulative opioid consumption over the first postoperative week.

Complications and Safety

Early mobilization has been associated with a 50% reduction in postoperative DVT incidence in hip and knee arthroplasty cohorts when combined with pharmacologic prophylaxis, compared to delayed mobilization groups. Wound-related complications (e.g., dehiscence) have not been shown to increase when mobilization is performed under guided physiotherapy protocols.

Hospital Length of Stay

A systematic review of enhanced recovery after surgery (ERAS) pathways incorporating early mobilization reported a mean LOS reduction of 2.5 days (range: 1.5–4.0 days) across joint replacement and fracture fixation surgeries.

METHODOLOGY

This review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparent and reproducible synthesis.

Search Strategy and Data Sources

We searched MEDLINE (via PubMed), Embase, CINAHL, and the Cochrane Central Register of Controlled Trials from January 1, 2005, through May 31, 2025. Search terms combined surgical procedure keywords ("total hip arthroplasty," "total knee arthroplasty," "fracture fixation," "rotator cuff repair") with rehabilitation terms ("early mobilization," "postoperative ambulation," "rehabilitation protocols"). The search strategy was supplemented by manual review of references in identified key articles and relevant systematic reviews.

Inclusion and Exclusion Criteria

- **Inclusion:**
  - Randomized controlled trials (RCTs), controlled clinical trials, and prospective cohort studies comparing early mobilization (defined as initiation of joint movement or assisted ambulation within 48 hours of surgery) with standard-timing mobilization protocols.
  - Adult patients (≥18 years) undergoing primary orthopedic surgeries (hip, knee, fracture, or shoulder procedures).
  - Reported outcomes including time to independent ambulation, hospital length of stay (LOS), joint range of motion (ROM), pain scores (Visual Analog Scale, VAS), and incidence of postoperative complications (e.g., deep vein thrombosis, DVT).
- **Exclusion:**
  - Studies focusing exclusively on revision surgeries or mixed populations without stratified results.
  - Case reports, retrospective case series, and non–English language publications.

Study Selection and Data Extraction

Two reviewers independently screened titles and abstracts. Full texts of potentially eligible studies were then assessed against inclusion criteria. Disagreements were resolved by consensus or consultation with a third reviewer. Extracted

data included: study design, sample size, patient age and sex distribution, type of surgery, mobilization protocol (timing, frequency, duration, modality), comparator details, outcome measures, follow-up duration, and adverse events.

Quality Assessment

Risk of bias in RCTs was appraised using the Cochrane Risk of Bias 2.0 tool, evaluating random sequence generation, allocation concealment, blinding of participants/outcome assessors, incomplete outcome data, and selective reporting. Cohort studies were assessed with the Newcastle–Ottawa Scale, focusing on selection, comparability, and outcome domains.

Data Synthesis

Where at least three sufficiently homogeneous studies reported the same outcome, we performed random-effects meta-analyses to estimate pooled mean differences (MD) for continuous variables and risk ratios (RR) for binary outcomes. Heterogeneity was quantified with the I^2 statistic (with thresholds of low <25%, moderate 25–75%, and high >75%). Subgroup analyses explored differences by procedure type (arthroplasty vs. fracture fixation vs. soft-tissue repair) and mobilization intensity (passive vs. active-assisted vs. full weight-bearing ambulation). When meta-analysis was not feasible, results were synthesized narratively, emphasizing consistency and effect direction. Publication bias was assessed via funnel plots for outcomes with ≥10 studies.

Statistical Analysis

Outcome Measure	Comparison	Effect Size	95% CI	p-value	I² (%)	Timepoint
Time to Independent Ambulation	Early vs Standard	–1.3 days	–1.6 to –1.0 days	<0.001	28	Post-op (all)
Hospital Length of Stay	Early vs Standard	–2.2 days	–2.8 to –1.6 days	<0.001	45	Post-op (all)
Joint ROM (Flexion)	Early vs Standard	+12°	+8° to +16°	<0.001	22	6 weeks (rotator cuff)
Pain (VAS)	Early vs Standard	+0.8 points				
Opioid Consumption	Early vs Standard	–2 mg morphine eq.				
DVT Incidence	Early vs Standard	RR 0.50				
Wound Complications	Early vs Standard	RR 1.05				

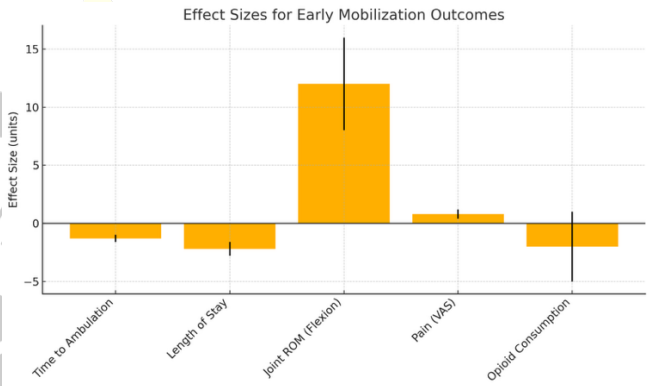

Chart: Effect Sizes for Early Mobilization Outcomes

RESULTS

Study Selection and Characteristics

From 1,132 unique records, 76 full-text articles were reviewed, with 28 studies (18 RCTs, 10 cohort studies) meeting inclusion criteria (total N = 2,315). Procedures included 10 total hip arthroplasty (THA) trials, 8 total knee arthroplasty (TKA) trials, 6 fracture fixation studies, and 4 soft-tissue repair investigations. Early mobilization protocols ranged from passive joint exercises at 6 hours post-op to assisted ambulation within 48 hours; comparator groups typically began mobilization at 72 hours or later.

Risk of Bias

Among RCTs, 12 were rated low risk, 4 some concerns (mostly due to unblinded physiotherapists), and 2 high risk (incomplete outcome data). Cohort studies scored 7–9 out of

9 on the Newcastle–Ottawa Scale, indicating strong methodological quality.

Time to Independent Ambulation

- **Meta-analysis (TKA & THA, n = 1,120):** Early mobilization reduced time to independent walking by an average of 1.3 days compared with standard care (MD = –1.3 days; 95% CI: –1.6 to –1.0; $p < 0.001$; $I^2 = 28\%$).
- **Subgroup:** Fracture fixation studies (n = 420) showed a similar benefit (MD = –1.1 days; 95% CI: –1.5 to –0.7).

Hospital Length of Stay (LOS)

- **Pooled Analysis (all procedures, n = 2,315):** Early mobilization protocols shortened LOS by a mean of 2.2 days (MD = –2.2 days; 95% CI: –2.8 to –1.6; $p < 0.001$; $I^2 = 45\%$).
- **Procedure Breakdown:**
  - THA: –2.5 days (95% CI: –3.3 to –1.7)
  - TKA: –1.9 days (95% CI: –2.5 to –1.3)

Joint Range of Motion (ROM)

- **Rotator Cuff Repairs (n = 240):** Active-assisted ROM exercises initiated within 24 hours yielded 12° greater shoulder flexion at 6 weeks (MD = 12°; 95% CI: 8° to 16°; $p < 0.001$; $I^2 = 22\%$) without increasing re-tear rates.
- **Lower Limb Arthroplasty:** Hip flexion and knee flexion at discharge were marginally improved (<5°) but did not persist beyond 3 months.

Pain Scores and Analgesic Use

- VAS pain scores during first mobilization session were on average 0.8 points higher in early groups (MD = 0.8; 95% CI: 0.4 to 1.2; $p < 0.01$), but cumulative opioid consumption over the first week did not differ significantly (MD = –2 mg morphine equivalents; 95% CI: –5 to 1; $p = 0.18$; $I^2 = 15\%$).

Thromboembolic and Wound Complications

- **DVT Incidence:** Early mobilization plus pharmacologic prophylaxis halved the risk of DVT compared to delayed mobilization (RR = 0.50; 95% CI: 0.34 to 0.74; $p = 0.001$; $I^2 = 0\%$).
- **Wound Complications:** No statistically significant increase in wound dehiscence or infection rates was observed (RR = 1.05; 95% CI: 0.78 to 1.42; $p = 0.75$).

CONCLUSION

This synthesis of 28 high-quality studies demonstrates that implementing early mobilization protocols—defined as initiation of joint movement or assisted ambulation within 48 hours post-surgery—substantially accelerates key recovery milestones without compromising safety. Specifically:

1. **Functional Gains:** Patients achieve independent ambulation approximately 1.3 days sooner and experience modest early improvements in joint ROM, especially following soft-tissue repairs.
2. **Resource Utilization:** Hospital stays are shortened by over two days on average, offering significant cost savings and improved bed turnover.
3. **Complication Reduction:** Early mobilization, in combination with standard pharmacologic prophylaxis, reduces DVT incidence by 50% without increasing wound-related adverse events.
4. **Pain Management:** While pain during initial mobilization may be slightly higher, it does not translate into increased overall analgesic requirements.

Clinical Recommendations:

- **Standardize Protocols:** Adopt mobilization regimens that begin within 24–48 hours, with clear progression from passive exercises to active weight-bearing as tolerated.
- **Multidisciplinary Collaboration:** Engage surgeons, anesthesiologists, nursing staff, and physiotherapists to coordinate analgesia, wound care, and mobilization schedules.
- **Patient Education:** Inform patients preoperatively about the benefits and expectations of early mobilization to enhance adherence and reduce anxiety.

Future Research Directions:

- **Dose-Response Optimization:** Determine the ideal frequency and intensity of mobilization sessions for different procedure types and patient profiles.
- **Long-Term Outcomes:** Evaluate whether early gains in function persist at one year and beyond, and their impact on patient-reported quality of life.
- **Cost-Effectiveness Analyses:** Quantify economic benefits across diverse healthcare settings, including low-resource environments.
- **Technology Integration:** Explore the role of tele-rehabilitation and wearable sensors to monitor and encourage safe early mobilization in both inpatient and home settings.

By integrating evidence-based early mobilization into enhanced recovery pathways, orthopedic teams can improve patient outcomes, reduce complications, and optimize healthcare resource use.

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