narra j

Review Article

Effectiveness of early weight-bearing rehabilitation protocols on outcomes after surgical fixation of pelvic and acetabular fractures: A systematic review

Muhammad A. Junaidi[1,2], Rizki F. Suskhan[1*] and Wilton W. Iskandar[1,2]

[1]Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia; [2]Division of Trauma, Department of Orthopedic and Traumatology, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

*Corresponding author: rfauzi760@gmail.com

Abstract

Optimal postoperative weight-bearing management following surgical fixation of pelvic and acetabular fractures remains incompletely defined. Prolonged restriction carries well-recognized risks of immobility-related morbidity, yet the safety and efficacy of early weight bearing (EWB) after screw-based constructs have not been rigorously synthesized. This review evaluates the available evidence on fixation stability, functional recovery, and complication rates following explicitly prescribed EWB protocols after surgical fixation of pelvic and acetabular fractures using screw-dominant or minimally invasive stabilization constructs. A systematic review was conducted in accordance with PRISMA 2020 guidelines. Eligible studies included adult patients who underwent screw-dominant or minimally invasive surgical fixation for pelvic or acetabular fractures and whose postoperative protocol explicitly prescribed EWB initiation within two weeks of surgery. Studies prescribing restricted or delayed weight bearing as the primary protocol were excluded. Methodological quality was appraised using the Methodological Index for Non-Randomized Studies (MINORS). Electronic databases (PubMed, Scopus, the Cochrane Library, and Google Scholar) were systematically searched as of December 2025. Six studies encompassing 297 patients met the final eligibility criteria. The evidence base consisted predominantly of retrospective case series, with one comparative cohort study identified. Across the included studies, catastrophic fixation failure was uncommon in carefully selected patients receiving EWB, and the included studies did not consistently demonstrate increased rates of loss of reduction. Functional recovery was generally favorable, and complication rates were low. Substantial heterogeneity across fracture morphology, fixation techniques, and EWB definitions precluded meta-analysis. Current literature on EWB following pelvic and acetabular fixation consists predominantly of low-level retrospective evidence subject to meaningful selection bias. While EWB appears feasible and catastrophic fixation failure was uncommon in these highly selected cohorts, the absence of high-quality comparative trials precludes confirmation of its widespread safety. EWB should currently be regarded as a feasibility concept applicable to carefully selected patients with stable fixation, rather than a routine recommendation. Prospective randomized trials are needed to establish definitive guidance.

Keywords: Pelvic fracture, acetabular fracture, early weight bearing, surgical fixation, rehabilitation

Introduction

Pelvic and acetabular fractures are serious injuries, usually associated with high-energy trauma, and frequently result in lasting disability [1,2]. Their incidence has been increasing, driven partly

https://narraj.org/

Received: May 26, 2026 - Accepted: July 1, 2026 - Published online: July 2, 2026

by rising rates of traffic accidents and partly by the growing proportion of older adults with fragile bones, who sustain these injuries after low-energy mechanisms [3,4]. Over the past few decades, management has shifted toward surgical fixation for unstable patterns, with the aim of restoring anatomy and enabling earlier mobilization [5,6]. Among available surgical options, percutaneous screw fixation has gained wider acceptance. Compared with open reduction and internal fixation, it is less invasive, associated with less blood loss, shorter operative times, and fewer wound complications, while still providing adequate stability in appropriately selected cases [7]. The technique is now applied to both pelvic ring and acetabular fractures, where the balance between mechanical stability and soft-tissue preservation is critical [8-11].

Rehabilitation is central to long-term recovery. Historically, patients were prescribed non-weight-bearing or minimally loaded protocols for extended periods, based on the premise that early loading risked displacing the fixation [12]. Prolonged immobility, however, carries its own burden of complications, including venous thromboembolism, respiratory compromise, skeletal muscle atrophy, and delayed return to independent function [13,14]. More recently, protocols permitting early weight bearing (EWB) have attracted attention, as they may facilitate faster recovery without compromising construct integrity [15-17].

The safety of early mobilization after surgical fixation of pelvic and acetabular fractures, particularly following screw-based constructs, remains debated. Biomechanical studies suggest that modern constructs can tolerate physiological loading in certain fracture configurations, but clinical evidence has been inconsistent: some series report favorable outcomes, while others raise concerns about loss of reduction or implant failure [18,19]. This uncertainty underscores the need for a systematic appraisal of the available clinical evidence. The present systematic review evaluates the effectiveness of explicitly prescribed EWB rehabilitation protocols on outcomes following surgical fixation of pelvic and acetabular fractures using screw-dominant or minimally invasive stabilization constructs.

Methods

Study design and registration

A systematic review was conducted to evaluate the effectiveness of EWB rehabilitation protocols on outcomes after surgical fixation of pelvic and acetabular fractures. This systematic review was designed and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines [20]. The review protocol was registered on PROSPERO (ID: CRD420251162546).

Search strategy

Relevant studies were identified through systematic searches of PubMed, Scopus, Cochrane Library, and Google Scholar. The search was conducted as of December 2025, without restriction on publication language. The search strategy combined controlled vocabulary terms (including MeSH headings) and free-text keywords related to pelvic and acetabular fractures, screw-based internal fixation, and postoperative protocols permitting EWB. Each database was searched using syntax and Boolean operators appropriate to that platform. Google Scholar was used as a supplementary tool to identify grey literature not indexed in the primary databases; only the first 200 results were reviewed using the same core keyword combinations. Reference lists of all included studies were screened manually. The complete search strategies, including Boolean operators and search strings for each database, are presented in **Table 1**.

Table 1. Search strategy used for each database

Database	Search terms/strategy	Filters	Hits
PubMed	("Pelvic"[Mesh] OR "Acetabulum"[Mesh] OR pelvic fracture* OR acetabular fracture*) AND ("Fracture Fixation, Internal"[Mesh] OR internal fixation OR screw fixation OR percutaneous fixation) AND (early mobilization OR "early weight bearing" OR "immediate weight bearing" OR "weight bearing as tolerated")	None	307

Database	Search terms/strategy	Filters	Hits
Scopus	(TITLE-ABS-KEY("pelvic fracture" OR "acetabular fracture") AND TITLE-ABS-KEY("internal fixation" OR screw OR percutaneous) AND TITLE-ABS-KEY("early weight bearing" OR "immediate weight bearing" OR "weight bearing as tolerated"))	None	803
Cochrane Library	"pelvic fracture*" AND "internal fixation" AND screw* AND ("early weight bearing" OR "early mobilization" OR "immediate weight bearing")	None	2
Google Scholar	"pelvic fracture" OR "acetabular fracture" AND "screw" AND "early weight bearing" OR "immediate weight bearing"	First 200 results screened	988

Eligibility criteria

Eligible studies included adult patients (aged 18 years or older) who underwent screw-dominant fixation constructs, including percutaneous fixation and selected minimally invasive stabilization techniques permitting early postoperative loading, for pelvic or acetabular fractures. The postoperative rehabilitation protocol was required to explicitly prescribe EWB initiation within two weeks of surgery. EWB was operationally defined as any protocol permitting weight bearing from the first postoperative day up to and including the end of the second postoperative week, encompassing immediate full weight bearing, partial weight bearing, or weight bearing as tolerated when initiated within this window. Studies using hybrid screw-plate constructs were eligible if fixation stability was achieved through screw-dominant or minimally invasive stabilization strategies and postoperative EWB was explicitly prescribed. Studies were required to report at least one of the following outcomes: fixation stability, radiological loss of reduction, functional scores, or complication rates.

Studies were excluded if the primary fixation employed open anterior plating systems without a screw-dominant stabilization component, or other constructs with biomechanical force distributions substantially different from screw-based fixation. Studies in which restricted or delayed weight bearing constituted the officially prescribed postoperative protocol were excluded, regardless of whether patient non-compliance was documented. Studies lacking any prescribed EWB arm, those confined to conservative management, those involving pediatric populations, and secondary sources such as reviews, editorials, and conference abstracts were also excluded. Studies with sample sizes below ten were omitted. Studies addressing elective reconstructive procedures, such as periacetabular osteotomy, were excluded to maintain focus on acute fracture management.

Study selection and data extraction

Two reviewers (MAJ and RFS) independently screened titles and abstracts of all retrieved records against the predefined eligibility criteria. Full texts of potentially eligible records were then retrieved and assessed independently by both reviewers. Disagreements at any stage were resolved by consensus discussion. Data from eligible studies were subsequently extracted independently by both reviewers using a standardized form, capturing study design, sample size, patient demographics, fracture classification, fixation method, the explicit timing and definition of the EWB protocol, follow-up duration, and all reported clinical and radiological outcomes.

Quality assessment

Methodological quality and risk of bias were assessed independently by each reviewer using the Methodological Index for Non-Randomized Studies (MINORS) [21]. The MINORS instrument evaluates non-comparative studies across eight items (maximum score 16) and comparative studies across twelve items (maximum score 24). Each item is scored as 0 (not reported), 1 (reported but inadequate), or 2 (reported and adequate). For the purposes of this review, scores above 70% were classified as low risk of bias, scores between 50% and 70% as moderate risk, and scores below 50% as high risk. Results are presented both in narrative form and in tabular format.

Synthesis

Given the substantial heterogeneity across included studies in fracture morphology, fixation techniques, rehabilitation protocol definitions, and outcome reporting, meta-analysis was not appropriate. Heterogeneity was assessed qualitatively across these clinical and methodological

dimensions; variation in EWB definitions alone, ranging from immediate full weight bearing on postoperative day one to progressive partial loading initiated within two weeks, rendered statistical pooling inappropriate. Findings were therefore synthesized narratively, with results presented in structured tables alongside descriptive summaries.

Results

Study selection

The initial systematic search across PubMed (n=307), Scopus (n=803), the Cochrane Library (n=2), and Google Scholar (first 200 results) yielded a total of 1362 records (**Figure 1**). Following the removal of 276 duplicate records, 1086 records were screened by title and abstract, resulting in the exclusion of 1050 records. Out of the remaining 36 reports sought for retrieval, 7 reports could not be retrieved. A full-text eligibility assessment was conducted on the remaining 29 reports, of which 23 were excluded (20 did not align with the PICO framework and 3 had a different outcome). Ultimately, six studies were included in the final synthesis. The selection process is illustrated in the PRISMA flow diagram (**Figure 1**).

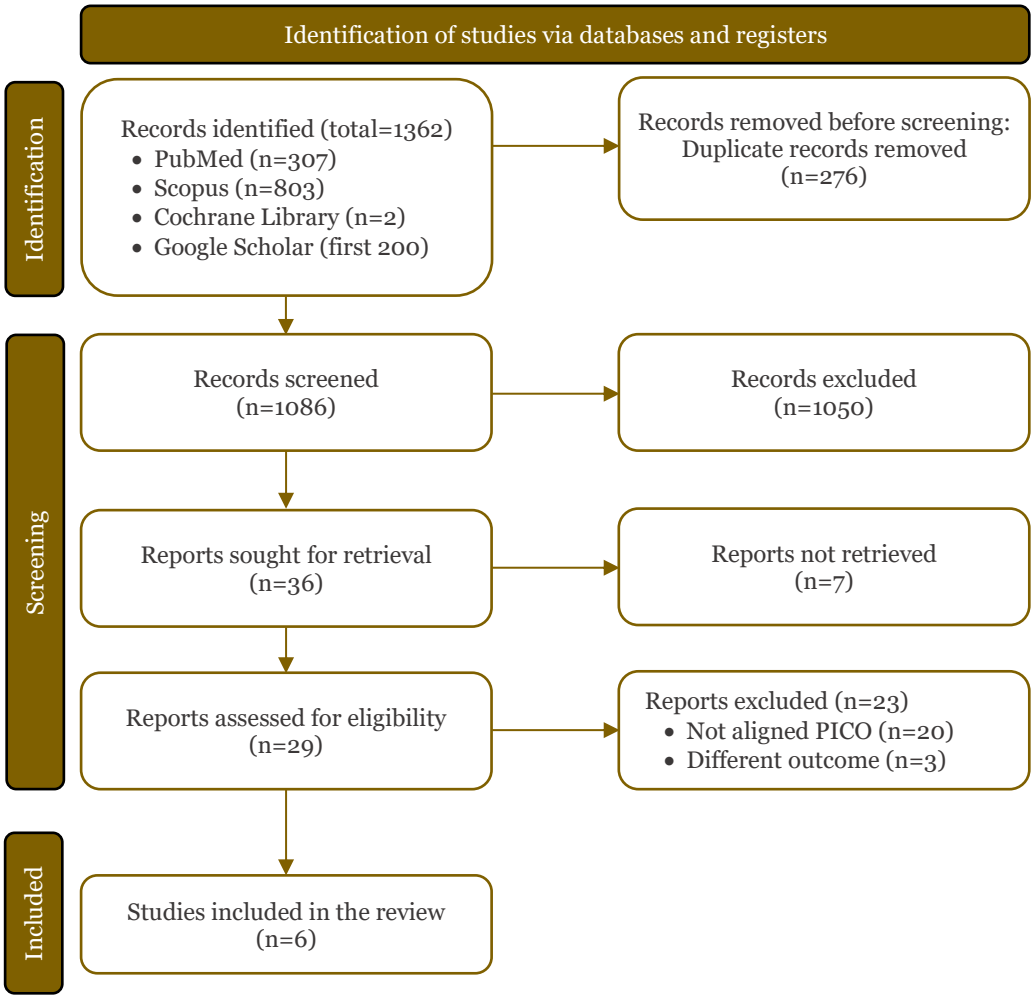

Figure 1. PRISMA flowchart showing the study selection.

Study characteristics

Characteristics of the included studies are summarized in **Table 2**. A total of six studies were evaluated, including five case series [22–26] and one retrospective cohort study [19]. The included studies encompassed a variety of pelvic and acetabular injuries, including stable and unstable pelvic ring disruptions (Tile B and C) as well as minimally displaced and anterior column acetabular fractures. Surgical fixation was primarily performed using percutaneous screw techniques. Postoperative rehabilitation protocols predominantly involved immediate full weight-bearing.

Effect of early weight-bearing on fixation stability and loss of reduction

Across the six included studies, fixation stability after explicitly prescribed EWB protocols was generally maintained (**Table 3**). Two studies [22,23] reported zero instances of loss of reduction in their respective cohorts of 22 and 27 patients, both mobilized to full weight bearing from postoperative day one [22,23]. In the only comparative cohort study identified [19], it found 3.6% rate of reduction loss in the EWB group (1 of 28 patients), compared with 12% in the restricted-protocol group (3 of 25 patients); a difference that did not reach statistical significance. Among patients with vertically unstable sacral fractures managed with triangular osteosynthesis, a study reported a 5.9% rate of loss of reduction requiring reoperation (2 of 34 patients), with 81% of the cohort achieving full weight bearing at a mean of 23 days postoperatively [15]. Another study reported no clinically significant secondary displacement in an elderly cohort of 21 patients mobilized with touch-down weight bearing from postoperative day one, progressing to full weight bearing by four weeks [10]. A study with the largest series (143 patients included) reported a 100% fracture union rate within the first three postoperative months, demonstrating excellent structural stability with zero reported cases of secondary displacement or loss of reduction [26]. The only hardware-related complication observed was a single case of isolated screw back-out (0.7%) that required subsequent surgical removal after fracture healing [26].

Effect of early weight-bearing on functional outcomes

Functional outcomes were reported across most included studies, primarily using the Merle d'Aubigne score. One study reported a mean score of 17.4, classified as Very Good, and additionally reported a mean Short Musculoskeletal Function Assessment (SMFA) score of 20.2, where lower scores indicate better function [22]. This represented the only patient-reported outcome measure identified across the included studies. Another study [10] reported that 17 of 18 elderly patients achieved Good or Excellent Modified Merle d'Aubigne (Matta) scores at a mean follow-up of 3.5 years [10]. A study found that 66.6% of patients aged over 65 years had returned to their pre-injury walking distance by six weeks [23]. Another study also reported a 93% rate of return to pre-injury occupational activity at one year [26]. Formal functional outcome scores were not reported by two studies [15,19], limiting direct comparison across all six studies.

Effect of early weight-bearing on implant-related complications and reoperations

Rates of implant failure and reoperation were low across the included EWB cohorts. One study noted a higher rate of asymptomatic hardware breakage in the EWB group relative to the restricted group, though none required reoperation [19]. Another study reported hardware loosening in 9% of patients (3 of 34), with a reoperation rate of 6% for loss of reduction [15]. Across the remaining four studies, the reoperation rate for fixation failure ranged from 0% to 0.7% [10,22,23,26].

Effect of early weight-bearing on other reported complications

Deep infection rates were low across included studies, ranging from 0% to 6% [15,22,25,26]. A study specifically reported a 6% rate of local infections, alongside other localized complications, including wound necrosis (3%) and iatrogenic nerve lesions (3%) [15]. Regarding venous thromboembolism (VTE), a study [19] reported zero events in the EWB group, compared with three events in the restricted-protocol comparator group [19]. No VTE events were reported by two studies [10,22]. One study did not report VTE specifically, but noted a deep infection rate of 0.7% [26].

Risk of bias

Methodological quality was appraised using the MINORS criteria and is presented in **Table 4** [21]. One comparative study [19] achieved a low risk of bias, driven by clearly defined endpoints, a concurrent comparator group, and adequate follow-up. Another study [25] also achieved a low risk of bias among the non-comparative studies, reflecting clear outcome definition, consecutive patient inclusion, and a relatively long follow-up period. Three studies [19,22,23] were classified as moderate risk, while one study [26] was classified as high risk owing to limited detail in follow-up reporting and ambiguous patient selection criteria.

Table 2. Characteristics of included studies

Study (year)	Design	n	Age (year)	Male : female	Fracture type	Fixation	Protocol	Follow-up	Key outcomes
Kazemi (2012) [22]	Case series	28 (baseline) /22 (final)	49	21:7	Acetabular (anterior column/ACPHT)	Percutaneous screws	Immediate FWB (POD 1)	39 months	0% reduction loss. Merle Score 17.4. SMFA 20.2.
Benhenneda (2022) [23]	Case series	27	75.5	9:18	Simple acetabular/pelvic ring	Percutaneous screws	Immediate FWB (POD 1)	6 weeks	0% reduction loss. 66.6% returned to pre-injury walking distance.
Poole (2022) [19]	Retrospective cohort	53	45.7	36:17	Pelvic ring (Tile B)	Screws/plates (screw-dominant)	G1 (n=28): Early WBAT; G2 (n=25): Restricted 6 weeks	10 months	No significant difference in reduction loss or reoperation. 0 VTE in EWB vs 3 in RWB.
Schildhauer (1998) [15]	Case series	34	35	26:8	Sacral (Tile C, vertically unstable)	Triangular osteosynthesis	Early progressive WB	19 months	81% FWB at mean 23 days. 5.9% reoperation for loss of reduction.
Mouhsine (2005) [25]	Case series	21 (baseline) /18 (final)	81	12:9	Acetabular (minimally displaced)	Percutaneous screws	TDWB POD 1; FWB at 4 weeks	3.5 years	0% displacement. 17/18 patients achieved good/excellent Modified Merle (Matta) Score
Qoreishi (2019) [26]	Case series	143	29	95:48	Pelvic ring and acetabular (mixed)	Percutaneous screws	Tolerated WB (POD 1-3)	1 year	All FWB by 3 mo. 93% returned to pre-injury occupation. 0.7% screw back-out.

ACPHT: anterior column posterior hemitransverse; FWB: full weight-bearing; ORIF: open reduction internal fixation; POD: postoperative day; RWB: restricted weight-bearing; SMFA: short musculoskeletal function assessment; TDWB: touch-down weight-bearing; VTE: venous thromboembolism; WB: weight-bearing; WBAT: weight-bearing as tolerated.

Table 3. Summary of outcomes across included studies

Study	Protocol	Loss of reduction	Implant failure	Reoperation rate	Functional outcome	Other complications
Kazemi (2012) [22]	Immediate FWB	0%	0%	0%	Merle Score 17.4 (Excellent); SMFA 20.2	0% infection, DVT, heterotopic ossification.
Benhenneda (2022) [23]	Immediate FWB	0%	0%	3.7% (1/27), screw removal due to persistent pain	66.6% returned to pre-injury walking by 6 weeks	All united at 6 wk.
Poole (2022) [19]	EWB vs. RWB	EWB: 3.6% (1/28) vs. RWB: 12% (3/25)	Higher asymptomatic breakage in EWB; no loss of reduction	EWB: 3.6% vs. RWB: 4.0%	NR	VTE: 0 in EWB vs. 3 in RWB.
Schildhauer (1998) [15]	Early progressive WB	6% (2/34)	9% (3/34) loosening	6% (2/34) for loss of reduction	NR	pulmonary embolism: 3%; iatrogenic nerve lesion 3%; wound necrosis 3%; and local infections: 6 %.
Mouhsine (2005) [25]	TDWB POD 1; FWB at 4 weeks	0%	1 asymptomatic screw migration	0%	17/18 patients achieved good/excellent Modified Merle (Matta) Score	All united. 0% infection.
Qoreishi (2019) [26]	Tolerated WB (POD 1-3)	0%	0.7% (1/143) screw back-out	0.7% (1/143) for screw removal	93% returned to pre-injury occupation	Deep infection: 0.7%.

DVT: deep vein thrombosis; EWB: early weight-bearing; FWB: full weight-bearing; NR: not reported; POD: postoperative day; RWB: restricted weight-bearing; SMFA: short musculoskeletal function assessment; TDWB: touch-down weight-bearing; VTE: venous thromboembolism; WB: weight-bearing

Table 4. Risk of bias assessment using the Methodological Index for Non-Randomized Studies (MINORS) criteria

Study	Study type	Core items (max 16)	Comparative items (max 8)	Total score	Percentage	Judgment
Kazemi [22]	Non-comparative	10	N/A	10/16	62.5%	Moderate
Benhenneda [23]	Non-comparative	11	N/A	11/16	68.8%	Moderate
Poole [19]	Comparative	11	7	18/24	75.0%	Low
Schildhauer [15]	Non-comparative	11	N/A	11/16	68.8%	Moderate
Mouhsine [25]	Non-comparative	12	N/A	12/16	75.0%	Low
Qoreishi [26]	Non-comparative	7	N/A	7/16	43.8%	High

A consistent limitation across the majority of included studies was the absence of a concurrent comparator group. As a result, it was not possible to determine whether observed outcomes were attributable to EWB *per se* or to fracture complexity, surgical expertise, and patient selection.

Discussion

This systematic review identified six studies evaluating explicitly prescribed EWB protocols following surgical fixation of pelvic and acetabular fractures using screw-dominant or minimally invasive constructs, encompassing 297 patients. The principal finding is that, within these carefully selected cohorts, complete fixation failure (mechanical collapse requiring revision surgery) and loss of reduction were uncommon but present. Functional recovery was generally favorable, and complication rates were low. These observations are clinically plausible, given the biomechanical capacity of modern screw-based constructs to withstand physiological loading in appropriately selected fracture patterns. However, the evidence base is predominantly retrospective, non-comparative, and subject to substantial selection bias, which limits the strength of any practice-level inference [10,15,19,22,23,26].

A critical consideration when interpreting the favorable outcomes reported across the included studies is confounding by indication. The decision to permit EWB was, in each series, made by experienced surgeons on the basis of intraoperative assessment of construct stability, fracture morphology, and patient-specific factors. Patients who received EWB were therefore not representative samples but rather a group selected by clinical judgement as suitable candidates. The absence of fixation failure in the two included series [22,23] may reflect exemplary patient selection as much as it demonstrates the inherent safety of EWB [22,23]. This confounding cannot be adjusted for within a retrospective case series framework, and it represents the fundamental methodological barrier to any definitive conclusion.

Among the included studies, a study provided the most methodologically robust data as the only comparative cohort study [19]. Their finding that EWB did not significantly increase the rate of loss of reduction relative to a restricted protocol, and was associated with fewer VTE events, is the closest approximation to controlled evidence available in this field. Nonetheless, the retrospective nature of that study and the relatively small sample size limit the generalizability of its conclusions.

For patients, the potential benefits of EWB are clinically meaningful. Earlier mobilization reduces dependence, limits muscle atrophy, and supports psychological recovery by allowing patients to participate actively in their rehabilitation [26]. These advantages are particularly relevant in older adults, in whom prolonged immobility frequently precipitates secondary complications and may result in permanent reduction of functional status. Two studies [10,23] demonstrated that, when construct stability is confirmed, early mobilization can be pursued safely even in patients aged over 65 years.

From a biological and biomechanical standpoint, a rationale for EWB is well established. Mechanical loading is believed to stimulate bone healing through mechanotransduction pathways, promoting callus formation and osteoblast differentiation [27,28]. Conversely, prolonged immobilization is thought to reduce these stimuli, potentially impairing bone quality and delaying union [29]. Modern percutaneous screw constructs are designed to provide rigid stability while permitting the limited micro-motion conducive to secondary fracture healing, and biomechanical data have demonstrated their capacity to withstand cyclic physiological loads [30,31]. The detrimental systemic effects of immobility, including venous stasis, respiratory compromise, and skeletal muscle atrophy, provide additional biological justification for minimizing the duration of restricted weight bearing where construct stability permits [32,33].

EWB after pelvic and acetabular fracture fixation is not universally applicable; its safety depends on the interaction of several clinical variables. Bone quality is a primary determinant: older patients with osteoporosis and comminuted fracture patterns experience higher rates of loss of reduction, as weakened trabecular bone reduces screw purchase and overall construct rigidity [15]. Fracture morphology is equally important. Early loading appeared safe and effective in inherently stable patterns, such as isolated anterior column fractures, but required more robust constructs in vertically unstable injuries associated with higher shear forces during ambulation

[15,19,22]. The accuracy of reduction also proved critical: the studies reporting the best functional outcomes were those in which anatomic restoration was confirmed radiologically, whereas malreduction was associated with hardware loosening and uneven articular stress distribution.

Some limitations of the present review should be acknowledged. Only six studies met the eligibility criteria, with a total sample of 297 patients; therefore, definitive conclusions regarding the safety or efficacy of EWB cannot be drawn. The definition of EWB varied across studies, ranging from immediate full weight-bearing from postoperative day 1 to progressive partial loading initiated within 2 weeks, which limited direct comparisons. In addition, five of the six included studies were non-comparative case series, making it impossible to attribute outcomes causally to the EWB protocol rather than to patient selection, surgical experience, fixation strategy, or fracture characteristics. Substantial clinical heterogeneity was also present across fracture patterns, ranging from inherently stable pelvic ring injuries to vertically unstable sacral fractures. This heterogeneity limits the external validity of the synthesis and indicates that the findings should not be generalized across broader orthopedic populations without careful stratification by fracture severity and construct mechanics. Validated patient-reported outcome measures were used in only one study [22], whereas the remaining studies relied mainly on surgeon-reported functional scores, which may be susceptible to assessment bias. Follow-up duration was also insufficient in several studies to capture late complications, including post-traumatic osteoarthritis. Publication bias cannot be excluded, as studies reporting fixation failure under EWB protocols may have been less likely to be published or identified through the search strategy. Finally, the deliberate exclusion of primary delayed weight-bearing protocols may have introduced selection bias and narrowed the scope of the available evidence.

Prospective randomized controlled trials are necessary to establish reliable evidence in this area. Future trial designs should stratify patients by fracture classification and fixation method to allow subgroup analysis, and should employ validated patient-reported outcome instruments such as the SF-36 or EQ-5D alongside clinical and radiological endpoints. An extended follow-up, sufficient to assess the development of post-traumatic osteoarthritis, would substantially improve the understanding of long-term sequelae. Economic analyses examining the cost-effectiveness of early mobilization, including reduced inpatient rehabilitation and lower rates of immobility complications, would also strengthen the policy case for protocol revision.

Conclusion

The available evidence suggests that EWB following surgical fixation of pelvic and acetabular fractures using screw-dominant constructs is feasible and complete mechanical collapse of the construct requiring surgical revision was uncommon in carefully selected patients, though not entirely absent, particularly in vertically unstable fracture patterns. Functional recovery across included studies was generally satisfactory, and rates of serious complications were low. However, these findings derive predominantly from retrospective, non-comparative case series of limited sample size, and are subject to substantial confounding by indication. EWB should therefore be regarded as a feasibility concept appropriate for selected patients with confirmed construct stability, rather than as a routine postoperative recommendation. High-quality prospective trials with standardized EWB definitions and patient-reported outcomes are required before definitive guidance can be established.

Ethics approval

Not required.

Acknowledgments

None.

Competing interests

All the authors declare that there are no conflicts of interest.

Funding

This study received no external funding.

Underlying data

Derived data supporting the findings of this study are available from the corresponding author on request.

Declaration of artificial intelligence use

AI-based language models, ChatGPT, Gemini, and Claude, were employed for language refinement (improving grammar, sentence structure, and readability of the manuscript) and technical writing assistance (providing suggestions for structuring complex technical descriptions more effectively). Authors confirmed that all AI-assisted processes were critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article were solely made by the authors.

How to cite

Junaidi MA, Suskhan RF, Iskandar WW. Effectiveness of early weight-bearing rehabilitation protocols on outcomes after surgical fixation of pelvic and acetabular fractures: A systematic review. Narra J 2026; 6 (2): e3122 - http://doi.org/10.52225/narra.v6i2.3122.

References

1. Kannus P, Palvanen M, Niemi S, *et al.* Epidemiology of osteoporotic pelvic fractures in elderly people in Finland: Sharp increase in 1970-1997 and alarming projections for the new millennium. Osteoporos Int 2000;11(5):443-448.
2. Ochs BG, Marintschev I, Hoyer H, *et al.* Changes in the treatment of acetabular fractures over 15 years: Analysis of 1266 cases treated by the German Pelvic Multicentre Study Group (DAO/DGU). Injury 2010;41(8):839-851.
3. Gänsslen A, Hüfner T, Krettek C. Die bildwandergestützte, perkutane transiliosakrale Schraubenfixation instabiler Beckenverletzungen. Oper Orthop Traumatol 2006;18(3):225-244.
4. Rommens PM, Hofmann A. Comprehensive classification of fragility fractures of the pelvic ring: Recommendations for surgical treatment. Injury 2013;44(12):1733-1744.
5. Rommens PM, Hofmann A, Kraemer S, *et al.* Operative treatment of fragility fractures of the pelvis: a critical analysis of 140 patients. Eur J Trauma Emerg Surg 2022;48(4):2881-2896.
6. Matta JM. Fractures of the acetabulum: Accuracy of reduction and clinical results in patients managed operatively within three weeks after the injury. J Bone Jt Surg 1996;78(11):1632-1645.
7. Einhorn S, Höch A, Osterhoff G, *et al.* Comparison of percutaneous screw fixation to open reduction and internal fixation in acetabular fractures: A matched pair study regarding the short-term rate of conversion to total hip arthroplasty and functional outcomes. J Clin Med 2023;12(3).
8. Routt MLC. Iliosacral screw fixation: Early complications of the percutaneous technique. J Orthop Trauma 1997;11(8):584-589.
9. Bousbaa H, Ouahidi M, Louaste J, *et al.* Percutaneous iliosacral screw fixation in unstable pelvic fractures. Pan Afr Med J 2017;27:244.
10. Mouhsine E, Garofalo R, Borens O, *et al.* Percutaneous retrograde screwing for stabilisation of acetabular fractures. Injury 2005;36(11):1330-1336.
11. Caviglia H, Mejai A, Landro ME, *et al.* Percutaneous fixation of acetabular fractures. EFORT Open Rev 2018;3(5):326-334.
12. Tornetta P. Non-operative management of acetabular fractures. The use of dynamic stress views. J Bone Jt Surg Br 1999;81(1):67-70.
13. Parry SM, Puthucheary ZA. The impact of extended bed rest on the musculoskeletal system in the critical care environment. Extreme Physiol Med 2015;4(1):16.
14. Arinzon Z, Fidelman Z, Zuta A, *et al.* Functional recovery after hip fracture in old-old elderly patients. Arch Gerontol Geriatr 2005;40(3):327-336.
15. Schildhauer TA, Josten C, Muhr G. Triangular osteosynthesis of vertically unstable sacrum fractures: A new concept allowing early weight-bearing. J Orthop Trauma 1998;12(5):307-314.

16. Murena L, Canton G, Hoxhaj B, *et al.* Early weight bearing in acetabular and pelvic fractures. Acta Biomed 2021;92(4):e2021236.
17. Lommerse MI, Mennen AHM, Bloemers FW, *et al.* Early weight-bearing after acetabular fractures in the older patient: A systematic review. EFORT Open Rev 2025;10(9):718-725.
18. Rickman M, Link BC, Solomon LB. Patient weight-bearing after pelvic fracture surgery—A systematic review of the literature: What is the modern evidence base? Strateg Trauma Limb Reconstr 2019;14(1):45-52.
19. Poole WEC, Neilly DW, Rickman MS. Is unrestricted weight bearing immediately after fixation of rotationally unstable pelvic fractures safe? BMC Musculoskelet Disord 2022;23(1).
20. Page MJ, McKenzie JE, Bossuyt PM, *et al.* The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ 2021:n71.
21. Slim K, Nini E, Forestier D, *et al.* Methodological index for non-randomized studies (MINORS): Development and validation of a new instrument. ANZ J Surg 2003;73(9):712-716.
22. Kazemi, Namdar MD, Archdeacon M. Immediate full weight-bearing after percutaneous fixation of anterior column acetabulum fractures. J Orthop Trauma 2012;26(2):73-79.
23. Benhenneda R, Letissier H, Dubrana F, *et al.* Immediate full weight bearing after pelvic percutaneous fixation by screw for simple acetabular and pelvic ring fractures in patients older than sixty-five years. Int Orthop 2022;46(10):2413-2421.
24. Schildhauer TA, Josten C, Muhr G. Triangular osteosynthesis of vertically unstable sacrum fractures: A new concept allowing early weight-bearing. J Orthop Trauma 1998;12(5):307-314.
25. Mouhsine E, Garofalo R, Borens O, *et al.* Percutaneous retrograde screwing for stabilisation of acetabular fractures. Injury 2005;36(11):1330-1336.
26. Qoreishi M, Seyyed Hosseinzadeh HR, Safdari F. Clinical results of percutaneous fixation of pelvic and acetabular fractures: A minimally invasive internal fixation technique. Arch Bone Jt Surg 2019;7(3):284-290.
27. Wang L, You X, Zhang L, *et al.* Mechanical regulation of bone remodeling. Bone Res 2022;10(1).
28. Klein-Nuled J, Bacabac RG, Mullender MG. Mechanobiology of bone tissue. Pathol Biol 2005:576-580.
29. Augat P, Hollensteiner M, von Rüden C. The role of mechanical stimulation in the enhancement of bone healing. Injury 2021;52:S78-S83.
30. Kazakia GJ, Tjong W, Nirody JA, *et al.* The influence of disuse on bone microstructure and mechanics assessed by HR-pQCT. Bone 2014;63:132-140.
31. Rolvien T, Amling M. Disuse osteoporosis: Clinical and mechanistic insights. Calcif Tissue Int 2022;110(5):592-604.
32. Llau J V., Kamphuisen P, Albaladejo P. European guidelines on perioperative venous thromboembolism prophylaxis. Eur J Anaesthesiol 2018;35(2):139-141.
33. Dirks ML, Wall BT, Snijders T, *et al.* Neuromuscular electrical stimulation prevents muscle disuse atrophy during leg immobilization in humans. Acta Physiol 2014;210(3):628-641.