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RESEARCH ARTICLE

Timing of Definitive Fixation in Orthopedic Trauma: Early Versus Delayed Surgery and Its Impact on Outcomes

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ABSTRACT

Background: In orthopaedic trauma, the timing of definitive fixation continues to be a crucial factor in determining results. While delayed fixation may be required in individuals who are unstable, early fixing is thought to minimise problems and hospital stays.

Methods:A total of 100 trauma patients were included and categorized into early fixation (<48 hours) and delayed fixation (>48 hours). Outcomes assessed included complications, length of hospital stay, infection rates, and functional recovery.This retrospective study examined the effects of early versus delayed fixation at IMS and SUM Hospital Campus 2 over a 1.5-year period (July 2024–December 2025).

Results: Significantly shorter hospital stays ($p<0.001$) and decreased complication rates ($p=0.03$) were linked to early fixation. Although not statistically significant, infection rates were lower in the early group. Early fixation produced higher functional results ($p=0.02$).

Conclusion: According to the study, early definitive fixation helps patients who are clinically stable recover more quickly by allowing for early mobilisation and lowering problems associated with immobilisation. It improves overall patient prognosis and lessens the burden of healthcare since it is linked to shorter hospital stays, reduced risk of non-union and infection, and better functional outcomes.

Keywords: orthopaedic trauma, immobilisation, prognosis, non-union, infection.

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Introduction

Globally, orthopaedic trauma is a leading source of morbidity and disability, especially in developing nations where falls and traffic accidents are frequent. With improvements in surgical methods, implants, and perioperative care, the treatment of fractures has changed dramatically. The timing of definitive fixation is one of the most important factors in management of orthopaedic trauma such as pressure sores, pulmonary complications, faster functional recovery. Those who are hemodynamically unstable, multiple organ involvement, head injury or previous comorbidities stabilise patients during initial period and then going for definitive fixation after they are physiologically stable[1]. In stable patients, early fixation—usually within 24 to 48 hours—is recommended because it permits early mobilisation, lessens pain, and minimises sequelae such pressure sores, deep vein thrombosis, and pulmonary issues. Additionally, it facilitates quicker functional recovery and shorter hospital stays[2]. However, not all patients can benefit from early surgery, particularly those with hemodynamic instability, polytrauma, or related systemic ailments. In critically ill patients, delayed fixation—which is frequently carried out after the patient's condition has been stabilised and optimized—is thought to be safer. The idea behind damage control orthopaedics is to stabilise patients temporarily before fixing them permanently after they are physiologically stable. Long-term delays, however, may raise the risk of infection, non-union, extended immobilisation, and postponed rehabilitation[3].

Decision-making is influenced by a number of variables, including the severity of the injury, patient comorbidities, surgical resource availability, and institutional protocols. Clinical practice needs to be guided by institution-specific data[4]. Numerous trauma patients

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are served by IMS and SUM Hospital Campus 2, offering a chance to examine actual results. The purpose of this study was to assess the effects of early versus delayed definitive fixation on complications, hospital stays, infection rates, and functional outcomes in patients with orthopaedic trauma[5].

Methods

Study Design: Retrospective observational study
Duration: July 2024 – December 2025 (1.5 years)
Sample Size: 100 patients

Grouping

- Early fixation (<48 hours): 50
- Delayed fixation (>48 hours): 50

Inclusion Criteria

- Patients with long bone fractures
- Age ≥18 years

Exclusion Criteria

- Pathological fractures
- Severe polytrauma requiring prolonged ICU stabilization

Parameters Studied

- Hospital stay
- Infection
- Complications
- Functional outcome

Statistical Analysis

The Student's t-test was used to evaluate continuous variables, and the Chi-square test was used to analyse categorical variables. These statistical techniques aided in identifying variations among comparison groups. Statistical significance was defined as a p-value of less than 0.05.

Results

Table 1: Age-wise Distribution

Age group (years)	*Early fixation (n=50)*	*Delayed fixation (n=50)*
18–30	16 (32%)	14 (28%)
31–40	18 (36%)	17 (34%)
41–50	10 (20%)	12 (24%)
>50	6 (12%)	7 (14%)
Male	34 (68%)	35 (70%)
Female	16 (32%)	15 (30%)

Table 2: Hospital Stay

Group	*Mean Days*	*p-value*
Early	6.5 ± 2.1	<0.001*
Delayed	11.8 ± 3.4	

Table 3: Complications

Complication	*Early*	*Delayed*	*p-value*
Infection	4	9	0.12
Non-union	2	6	0.04*
DVT	1	4	0.08

Table 4: Functional Outcome grades and outcome distribution

Functional outcome grade	*Score range*	*Characteristics*
Excellent	90–100	Full weight bearing, no pain, complete joint mobility, return to normal daily activities/work without limitation
Good	75–89	Mild pain or stiffness, slight restriction of movement, able to perform routine activities independently
Fair	50–74	Moderate pain, noticeable limitation of joint movement, difficulty in prolonged walking or physical activity
Poor	<50	Severe pain, marked restriction of mobility, dependence on support for ambulation, poor functional recovery

Table 5: Outcome Distribution

Outcome	*Early fixation*	*Delayed fixation*	*p-value*
Excellent	20	10	
Good	18	20	0.02*
Fair	8	12	
Poor	4	8	

Discussion

The current study assessed how patients with orthopaedic trauma fared clinically and functionally in relation to the timing of definitive fixation. The results showed that, in comparison to delayed fixation, early fixation was linked to superior overall outcomes, such as shorter hospital stays, fewer problems, and greater functional recovery. These findings corroborate the mounting data supporting early surgical stabilisation in trauma patients who have been carefully chosen.

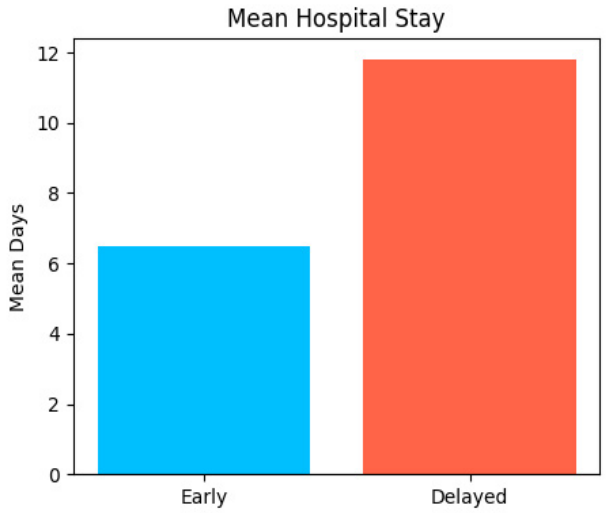

Figure 1: Mean hospital stay

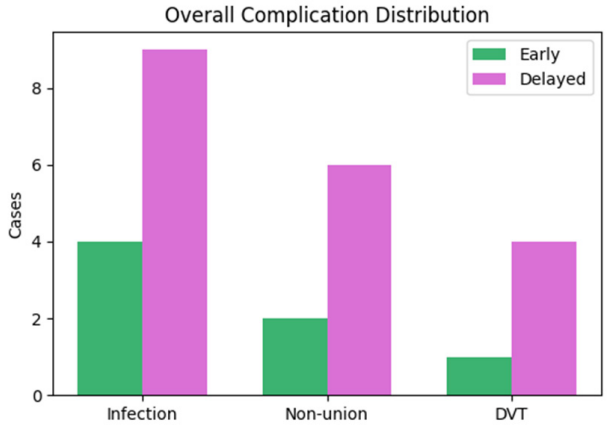

Figure 2: Overall complication distribution

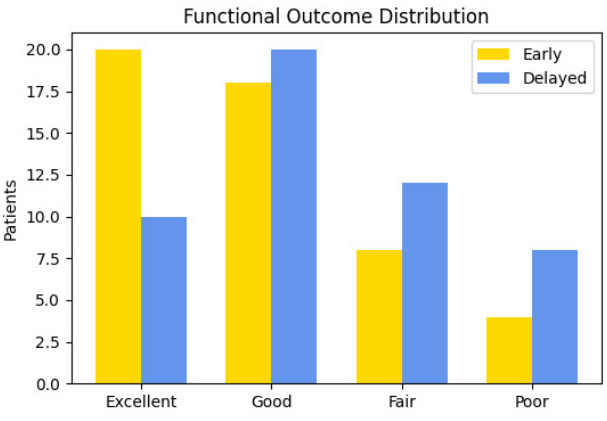

Figure 3: Functional outcome distribution

Patients who received early fixation in the current trial spent much less time in the hospital. Early stabilisation reduces lengthy immobilisation, speeds up mobilisation, and lowers the risk of secondary problems such pressure sores, lung infections, and deep vein thrombosis. Early fixation decreased intensive care stays and enhanced rehabilitation outcomes in polytrauma patients, according to Balakrishnan S*et al.,* 2025. Additionally, emphasised that prompt fracture stabilisation promotes better healing and an earlier return to function[6].

The delayed fixation group experienced a relatively greater incidence of surgical complications. Delayed surgery demonstrated a tendency towards greater wound infection and soft tissue problems, despite the fact that infection rates were not statistically significant. Long-term exposure of fracture sites, frequent manipulation, and postponed definitive care could all be contributing factors. In a similar vein, patients with delayed orthopaedic fixation had greater infection rates, according to a Yılmaz M, Tantekin MF, Kıvrak A, 2026 study[7]. Additionally, the current study found that delayed fixation instances had a much greater probability of non-union, highlighting the significance of early mechanical stability for the best possible bone healing. These results are consistent with the findings of Timisela KY, 2026, who showed that delayed fixing prolongs recovery and negatively impacts fracture union[8].

The early fixation group's functional results were noticeably better. Initiating physiotherapy, maintaining joint mobility, and preventing muscle atrophy are all made possible by early surgical intervention, which eventually improves functional performance. Patil R*et al*. 2025 observed similar findings, finding that early fracture repair enhanced trauma patients' quality of life and long-term mobility[9].

In some clinical circumstances, however, delayed fixation can still be required, especially for patients with severe polytrauma, hemodynamic instability, or related systemic injuries. In order to decrease surgical stress and lower the risk of death, damage control orthopaedics prioritises physiological stability prior to definitive fixation. Bakhsh K, Mengal MA, Hasani MT, 2023have been ardent supporters of this strategy for critically injured patients[10]..

There are some limitations to the current investigation. The results may not be as broadly applicable due to the retrospective approach and limited sample size. Furthermore, the evaluation of late problems such implant failure, persistent pain, and long-term functional loss was limited by the lack of long-term follow-up[11]. It

is advised that future prospective multicentric studies with bigger populations and longer follow-up times be conducted in order to confirm these results and determine the best scheduling guidelines for permanent orthopaedic fixation[12].

Conclusion

In orthopaedic trauma patients, this study shows that early definitive fixation is linked to better clinical results than delayed fixation. Early surgery lowers the risk of complications including non-union, improves functional recovery, and drastically shortens hospital stays. There was a trend towards fewer infections in the early group, despite the fact that infection rates were not statistically different. The use of early fixation in stable patients as part of contemporary trauma care regimens is supported by these findings. For patients who are not medically stable enough for early surgery, delayed fixation is nevertheless crucial. In these situations, patient safety is guaranteed by initial stabilisation and final fixation.

In general, the time of fixation should be customised according to the patient's health, the extent of the injury, and the resources at hand. When possible, early fixation should be promoted to enhance results and lessen the cost of treatment. Standardised criteria for the best time to perform surgery in cases of orthopaedic trauma require more research.

References

1. Devaney GL, Bulman J, King KL, Balogh ZJ, Ortho F. Time to definitive fixation of pelvic and acetabular fractures. J Trauma Acute Care Surg. 2018;89(4):730–5.
2. Klingebiel FK, Oertel MF, Kalbas Y, Balogh ZJ, Beeres FJP. Timing of definitive fracture fixation in patients with concomitant traumatic brain injuries – A systematic review of the literature by the IMPACT group American Congress of Rehabilitation Medicine Hospital Length of Stay. Eur J Trauma Emerg Surg. 2025;51(308):1–10.
3. Reinhard J, Schindler M, Straub J, Baertl S, Szymski D, Walter N, et al. Timing in orthopaedic surgery – Rethinking traditional myths with a critical perspective. Injury 2025;56(3):112165. A
4. Oochit K, Araiz M, Andrew I. Early vs . late definitive fixation of pelvic ring fractures in resuscitated polytraumatized patients : a systematic review and meta-analysis. Arch Orthop Trauma Surg. 2026;146(18):1–16.
5. Grier AJ, Chen KJ, Paul A V, Green CL, Richard MJ, Ruch DS, *et al*. Impact of Time to Fixation on Outcomes of Operative Treatment of Intra-articular Distal Radius Fractures. HAND. 2024;19(8):1269 –1276.
6. Balakrishnan S, Roy RT, Paul AJ, Ajith N. Association Between Surgical Timing and Clinical Outcomes in Elbow Fracture Management. Cureus. 2025;17(12):1–12.
7. Yılmaz M, Tantekin MF, Kıvrak A. Early Versus Delayed Plate Fixation in Pilon Fractures-Which Is More Advantageous ? J Am Podiatr Med Assoc Artic. 2026;116(25087):1–12.
8. Timisela KY. What is The Effectiveness of Early Versus Delayed Surgical Fixation of Orthopaedic Injuries on Mortality and Functional Outcomes in Multiply Injured Patients ? A Systematic Review. Int J Med Sci Heal Res. 2026;36(02):58–118.
9. Patil R, Baker MB, Binda DD, Hsieh A, Varghese S, He XA, et al. Efficacy and safety of early surgical fixation of fractures in patients with traumatic brain injury : a scoping review. J Oral Maxillofac Anesth. 2025;4(1):1–12.
10. Bakhsh K, Mengal MA, Hasani MT. Outcomes of Early Versus Delayed Surgical Intervention in Long Bone Fractures. P J M H S. 2023;17(12):547–9.
11. Byrne JP, Nathens AB, Gomez D, Pincus D. Timing of femoral shaft fracture fixation following major trauma : A retrospective cohort study of United States trauma centers. PLoS One. 2017;14(7):1–18.
12. Osman M, Almatar KA, Almatar F, Awad SA, Mohamed HK. Outcomes of Early Versus Delayed Definitive Surgical Intervention in Multisystem Trauma Patients : A Systematic Review of Timing Strategies in General Surgery Emergencies. Cureus. 2025;17(8):8–15.