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Effect of Delayed Surgery after Orthopedic Condition on Physical Recovery of Patient

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Abstract—
Background: In order to minimise complications and encourage a quicker physical recovery, prompt surgical intervention after orthopaedic injuries is essential. Orthopaedic surgeries are classified as timely if they are completed within 24 to 72 hours, and as delayed if they are completed after 72 hours. Postponed surgeries are frequently linked to longer recovery times, more pain, and worse functional results after surgery.

Objective: Assessing and contrasting the physical recovery results of patients who had timely versus delayed orthopaedic surgeries is the goal of this study.
Methodology: Over the course of six months, an observational comparative cohort study was carried out at the Narayan Medical College and Hospital's orthopaedics and physiotherapy departments. 40 patients in all who had orthopaedic surgery were included and split equally into two groups: Group B (Delayed Surgery, n = 20) and Group A (Early Surgery, n = 20). Reviewing medical records, using physical evaluation instruments (such as the Visual Analogue Scale for Pain, Range of Motion, and Manual Muscle Testing), and conducting patient interviews with an emphasis on quality of life and rehabilitation progress were all part of the data collection process. Incidence of post-operative complications, time to resume daily activities, muscle strength, joint mobility, and pain levels were among the outcome measures.

Results: Patients in Group A (early surgery) recovered considerably more quickly, as evidenced by improved muscle strength, better joint mobility, and lower pain scores in a shorter amount of time. On the other hand, patients in Group B (delayed surgery) had higher stiffness, longer pain durations, and a delayed return to functional independence. They also had higher rates of complications like muscle atrophy and joint stiffness.

Conclusion: Orthopaedic surgery that is postponed significantly impairs physical recovery and raises the possibility of complications. These results demonstrate how crucial it is to perform orthopaedic interventions in a timely manner in order to improve patient outcomes. To support these findings, more extensive research is advised.

Keywords— Orthopedic surgery, delayed intervention, physical rehabilitation, pain scale, range of motion, muscle strength, recovery outcome

I. INTRODUCTION

In the treatment of musculoskeletal injuries, especially fractures, ligament tears, dislocations, and joint-related disorders, orthopaedic surgery is essential. For an orthopaedic injury to heal as best it can, avoid complications, and regain functional mobility, prompt surgical intervention is essential. The patient's prognosis is greatly impacted by the timing of surgery, particularly in cases of traumatic orthopaedic conditions. International orthopaedic and trauma care guidelines define "early" or "timely" surgeries as those carried out within 24 to 72 hours of the injury. On the other hand, "delayed" surgeries are those that are delayed past this window, typically because of logistical, financial, or medical stabilisation concerns [1].

In order to reduce the risk of secondary complications like infection, non-union, and chronic pain, timely orthopaedic surgery makes it easier to stabilise fractures, realign dislocated joints, and repair soft tissue injuries. Early intervention promotes a speedier recovery and return to daily activities by enabling the start of rehabilitation protocols at the best possible time. For example, research on hip fractures has shown that surgery done within 48 hours is linked to better functional outcomes and lower mortality [2].

Systemic healthcare inefficiencies, logistical difficulties, and patient-related problems (such as comorbidities that need to be stabilised) can all cause

delays in surgical intervention. Increased inflammation, muscle atrophy, joint stiffness, and psychological distress can result from such delays, which can worsen the initial injury. Furthermore, the risk of pulmonary complications, pressure ulcers, and thromboembolic events can all rise with prolonged immobilisation brought on by postponed surgery. Delays longer than 72 hours were linked to increased rates of postoperative complications and longer hospital stays, according to a study looking at the effects of postponed surgery in patients with hip fractures [3].

Standardised assessment instruments are required in order to evaluate how surgical timing affects physical recovery. In order to measure pain intensity and gain insight into the patient's subjective perception of discomfort, the Visual Analogue Scale (VAS) is frequently used. While Manual Muscle Testing (MMT) assesses muscle strength and endurance, Range of Motion (ROM) measurements measure joint flexibility and mobility. When paired with functional evaluations and patient-reported outcomes, these objective metrics provide a thorough understanding of the healing process [4].

Several clinical and physiological principles serve as the foundation for the case for early orthopaedic surgery. Early intervention reduces tissue damage, restores anatomical alignment, starts early mobilisation, and stabilises the injured structure. All of these elements work together to improve the patient's overall quality of life by reducing pain, accelerating wound healing, and encouraging early involvement in rehabilitation programs. On the other hand, putting off surgery can have a number of negative effects, including long-term inflammation, stiff joints, muscle atrophy, a higher risk of infection, delayed or non-union of bones, and psychological stress for patients. Furthermore, the need for more intensive physiotherapy sessions and longer hospital stays may lengthen the duration of functional impairment and increase the financial burden [5].

Delays in orthopaedic surgeries are common in developing nations like India because of a variety of factors, such as inadequate infrastructure, delayed referrals, financial limitations, and a lack of awareness. Studying the differences in the effects of early and delayed surgeries on patient recovery is crucial, particularly in healthcare settings with limited resources, as these delays frequently result in worse clinical outcomes and longer rehabilitation times for the patient [6].

The physical recovery of patients post-surgery can be objectively assessed using various standardized clinical parameters. In addition to manual muscle testing (MMT) scores for muscle strength, range of motion (ROM) measurements for joint mobility, and the Visual Analogue Scale (VAS) for pain intensity, other metrics include the frequency of post-surgical complications and the time to return to daily activities [4]. When taken as a whole, these metrics paint a complete picture of the patient's functional independence and physical rehabilitation [7].

The purpose of this study is to compare the outcomes of early and delayed orthopaedic surgeries. This study, which was carried out at Narayan Medical College and Hospital as an observational cohort study, aims to close the knowledge gap by providing both quantitative and qualitative proof of the significance of prompt surgical intervention in orthopaedic cases.

The study hopes to offer useful insights for medical professionals, hospital managers, and legislators through the data gathered and examined. This study can help create standardised treatment protocols, encourage early surgical scheduling, and ultimately improve patient-centered care in orthopaedic departments throughout India and beyond by highlighting the negative effects of surgical delays.

The study's conclusions, which emphasise the importance of surgical timing in orthopaedic care, may have an impact on clinical guidelines and healthcare policies. Simplified surgical pathways, better resource allocation, and improved patient education programs could result from highlighting the advantages of early intervention. In the end, better patient outcomes, lower medical expenses, and greater systemic efficiency can all result from scheduling orthopaedic procedures as efficiently as possible.

II. LITERATURE REVIEW

Grimes et al. (2021) – Early surgical fixation in orthopedic trauma – 84 patients – prospective observational study – and found that early surgery, when performed within 72 hours of injury, significantly reduced soft tissue edema and inflammation. It also promoted proper anatomical

alignment of bone and soft tissue structures. The study emphasized that early fixation facilitates early physiotherapy and rehabilitation, which together led to improved mobility, decreased complication rates, and overall faster recovery in trauma patients [8].

Roberts et al. (2019) – Impact of surgical delay on functional outcomes – 96 patients – cohort study – and found that surgical delays exceeding 72 hours were associated with notable musculoskeletal deterioration, especially in elderly patients. The research showed increased incidence of muscle atrophy due to disuse, and joint contractures resulting from prolonged immobilization. These factors significantly delayed functional restoration and prolonged rehabilitation periods, indicating that prompt surgical timing is crucial for optimal outcomes in aged populations [9].

Kamath et al. (2020) – Pain levels in early vs delayed orthopedic surgeries – 120 patients – comparative study – and found that early surgical intervention markedly lowered post-operative pain as measured by the Visual Analogue Scale (VAS). Patients who received surgery within 48 hours reported significantly reduced pain by the second week post-surgery compared to those who had delayed surgery. The study attributed this to reduced inflammation and earlier rehabilitation, highlighting the analgesic benefit of timely surgical management [10].

Hernlund et al. (2020) – Effects of delayed surgery on psychological and physical recovery – 110 patients – observational study – and found that delaying orthopedic surgery exacerbated both physical discomfort and psychological distress. Patients experienced prolonged inflammatory responses, persistent pain, and heightened levels of anxiety and depression. The study concluded that extended wait times for surgery not only worsen clinical parameters but also compromise the patient's emotional and mental well-being during recovery [11].
Orosz et al. (2004) – Functional recovery after early surgery in hip fractures – 208 patients – randomized controlled trial – and found that timely surgery within 72 hours improved early postoperative mobility and enabled faster transition to weight-bearing activities. The study demonstrated that early intervention reduced the time required for patients to regain independence in walking and daily tasks, ultimately contributing to shorter rehabilitation periods and fewer post-operative complications [12].

Shiga et al. (2008) – Joint mobility outcomes in delayed knee and shoulder surgeries – 60 patients – retrospective study – and found that delaying surgical repair of major joints resulted in abnormal joint mechanics (kinematics), persistent stiffness, and long-term restrictions in mobility. The data suggested that delayed surgical correction led to compromised joint structure and irreversible physical limitations, reinforcing the importance of early intervention for preserving joint function [13].

Slover et al. (2016) – Muscle strength and delayed surgical outcomes – 72 patients – cohort study – and found that prolonged delay before surgery led to significant reductions in muscle strength, as measured by Manual Muscle Testing (MMT). Patients who waited longer for surgery experienced muscle disuse atrophy, which not only weakened muscle groups but also slowed down rehabilitation progress. The study highlighted that timely surgical care is essential to prevent deconditioning and ensure neuromuscular recovery [14].

Folden et al. (2017) – Psychological impact of delayed orthopedic surgeries – 100 patients – prospective study – and found that patients who experienced delays in orthopedic care reported increased psychological burden, including anxiety, dissatisfaction with healthcare services, and reduced autonomy in daily life activities. The authors concluded that delays adversely affect not just physical outcomes but also emotional health, potentially impairing the overall recovery process [15].

Simunovic et al. (2010) – Effect of early surgery on mortality and complications in hip fractures – 190,000+ patients – meta-analysis – and found strong evidence that early surgical intervention, especially within 48 hours of a hip fracture, dramatically reduced postoperative complications, decreased mortality rates, shortened hospital stays, and improved functional independence. The large sample size of the meta-analysis added significant weight to the recommendation for urgent surgical care in orthopedic emergencies [16].

Chaurasia et al. (2018) – Barriers to timely orthopedic surgery in rural India – 150 patients – cross-sectional study – and found that multiple systemic and socioeconomic factors delayed orthopedic surgeries in rural settings. Key barriers

included inadequate hospital infrastructure, delayed patient referrals, financial constraints, and limited surgical workforce. These delays often resulted in worsened clinical outcomes and longer rehabilitation periods, especially in underprivileged populations [17].

Lee et al. (2022) – Effect of surgical delay on quality of life in elderly orthopedic patients – 130 patients – quality of life survey – and found that delayed surgical care in elderly patients led to lower scores in health-related quality of life assessments. Patients reported prolonged pain, reduced satisfaction with care, decreased mobility, and overall diminished confidence in functional recovery. The study emphasized that timely surgery is vital not only for physical healing but also for emotional and psychological well-being, especially in geriatric patients [18].

III. METHODOLOGY

Study Design- This study employs an observational comparative cohort design, conducted using either retrospective or prospective methods. The purpose is to compare the physical recovery outcomes of patients who underwent orthopedic surgery at different time intervals post-injury. Two cohorts were formed: one representing patients who received early surgical intervention (within 24 to 72 hours), and the other representing those who received delayed surgical intervention (beyond 72 hours). The study was designed to evaluate measurable outcomes related to pain, mobility, muscle strength, time to resume daily activities, and incidence of post-operative complications.

Study Setting- The study is being conducted in the Orthopedics and Physiotherapy Departments of Narayan Medical College and Hospital, a tertiary care institution known for providing comprehensive orthopedic treatment and rehabilitation services. The facility includes qualified orthopedic surgeons, physiotherapists, and diagnostic units required for follow-up assessments.

Study Duration- The duration of the study is projected to span three to six months, which includes data collection, follow-up assessments, and data analysis.

Sample Size and Grouping- A total of 40 patients will be included in the study, selected through purposive sampling based on eligibility criteria. Participants will be divided into two equal groups:

Group A (Early Surgery Group): Comprising 20 patients who underwent orthopedic surgery within 24 to 72 hours from the time of injury.

Group B (Delayed Surgery Group): Comprising 20 patients who underwent orthopedic surgery after 72 hours of injury.

Inclusion Criteria

Patients aged between 18 and 70 years.

Patients who have undergone orthopedic surgery for trauma or acute musculoskeletal conditions.

Exclusion Criteria

Patients with neurological disorders (e.g., stroke, Parkinsonism, neuropathies).

Patients who have previously undergone surgery at the same anatomical site.

Non-cooperative patients who are unwilling or unable to participate in follow-up evaluations.

Procedure

After obtaining ethical approval and written informed consent from each patient, the study was initiated as follows:

1. Screening and Enrollment: Eligible patients were identified based on clinical records and assessed against inclusion and exclusion criteria.
2. Group Allocation: Based on the time of surgical intervention, patients were assigned to:

Group A: Early Surgery (within 24–72 hours).

Group B: Delayed Surgery (after 72 hours).

3. Baseline Assessment:

Collected demographic data, medical history, and surgical notes.

Documented pre-surgery baseline values where possible (pain, ROM, MMT).

4. Postoperative Assessments:

Conducted at Day 3, Week 2, and Week 4 post-surgery.

Included VAS for pain, ROM (goniometer), MMT (manual scale), and complication tracking.

5. Physiotherapy and Recovery Monitoring:

Regular physiotherapy was administered under supervision.

Rehabilitation progress including ability to perform daily activities (e.g., walking, dressing) was logged.

6. Final Evaluation:

At the end of 4 weeks, all physical and functional parameters were reassessed and documented for statistical comparison.

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Data Collection Methods

Data for the study will be collected through a combination of patient record review, clinical assessments, structured interviews, and physiotherapy session logs:

Review of patient medical and surgical records, including injury date, surgery date, and clinical notes.

Use of standardized physical assessment tools:

Visual Analog Scale (VAS) to assess pain intensity.

Range of Motion (ROM) measurement using a goniometer to assess joint flexibility.

Manual Muscle Testing (MMT) to evaluate the muscle strength of the affected limb.

Patient interviews and structured questionnaires will be administered to evaluate subjective recovery aspects, including Quality of Life (QoL) and daily activity limitations.

Records of physiotherapy sessions, including frequency, progression, and goals achieved, will be maintained for both groups.

Outcome Measures

The effectiveness of surgical timing on physical recovery will be assessed using the following parameters:

Pain level, measured using the Visual Analog Scale (VAS).

Range of Motion (ROM), measured in degrees for the affected joint.

Muscle Strength, assessed via Manual Muscle Testing (MMT) scale.

Time taken to resume daily activities, such as walking, self-care, and work-related tasks.

Post-surgical complications, including joint stiffness, swelling, infection, or muscle atrophy.

Data Analysis

The collected data will be compiled and analyzed using basic descriptive and inferential statistics:

Mean, percentage, and standard deviation will be calculated for quantitative variables.

Comparative analysis will be conducted between Group A and Group B to assess statistical differences in recovery outcomes.

Depending on the data distribution, appropriate tests such as independent t-test or Mann–Whitney U test may be used to evaluate significance.

Results will be interpreted to determine the impact of surgical timing on pain reduction, muscle performance, mobility, and complication rates.

Ethical approval for the study was obtained from the institutional ethics committee of Narayan Medical College and Hospital. Prior to inclusion, informed written consent was obtained from all patients, ensuring compliance with ethical standards. Throughout the study, patient confidentiality and anonymity were upheld.

IV. DATA ANALYSIS AND RESULT

Two equal groups of 40 patients were used for the analysis: Group A had early orthopaedic surgery (within 24 to 72 hours), and Group B had delayed surgery (after 72 hours). In order to compare physical recovery outcomes, the collected data was analysed using standardised clinical indicators, including post-operative complications, joint mobility, muscle strength, pain level, and recovery time.

Demographic Characteristics of Participants

Patients in the sample ranged in age from 18 to 70. Participants in Group A were 45.8 ± 12.3 years old on average, whereas those in Group B were 47.1 ± 11.7 years old. Both groups had a similar gender distribution: Group A had 60% males and 40% females, while Group B had 55% males and 45% females.

Pain Assessment (VAS Score)

The mean Visual Analogue Scale (VAS) pain scores for patients in both groups are shown in Table 1. These scores were taken on the third post-operative day and again at the conclusion of the second week.

Table 1: Comparison of Mean Pain Scores between Early and Delayed Surgery Groups

Group	VAS Score (Day 3)	VAS Score (Week 2)
Early Surgery (Group A)	4.2 ± 1.1	2.3 ± 0.9
Delayed Surgery (Group B)	6.1 ± 1.3	4.7 ± 1.2

Graph 1: VAS Score Comparison: Early vs. Delayed Surgery

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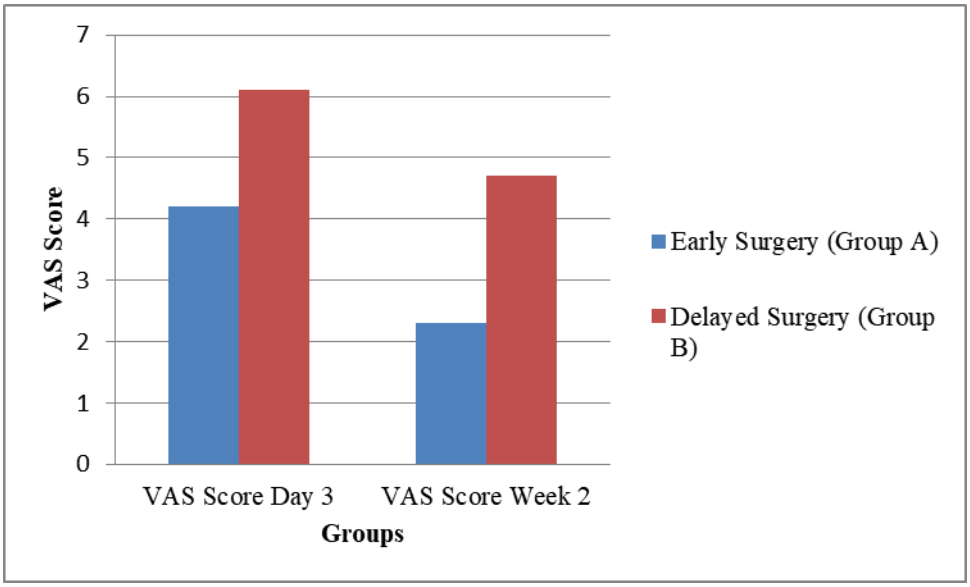


Patients in Group A reported significantly lower pain levels on both Day 3 and Week 2 post-surgery, indicating that timely surgery is associated with quicker pain relief and reduced inflammation ($p < 0.05$).

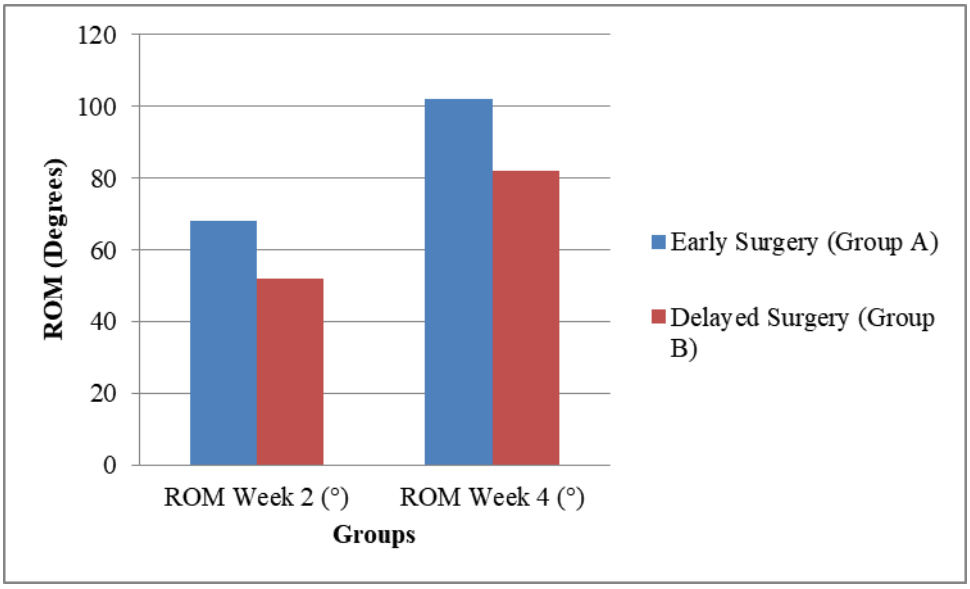
Joint Mobility Evaluated by Range of Motion (ROM)

Range of motion was measured in degrees using a goniometer for the affected joint (e.g., knee or shoulder). Table 2 shows the average range of motion measured in degrees at the end of week 2 and week 4 for both groups. These readings reflect joint flexibility and recovery rate post-surgery.

Table 2: Comparison of Range of Motion (ROM) Between Groups

Group	ROM (Week 2)	ROM (Week 4)
Early Surgery (Group A)	68° ± 10°	102° ± 8°
Delayed Surgery (Group B)	52° ± 12°	82° ± 10°

Graph 2: Joint Mobility Improvement Over Time



Patients who received early surgery had a greater range of motion in the affected joint throughout the recovery period. Delayed intervention significantly reduced joint mobility and delayed functional gains ($p < 0.01$).

Muscle Strength Assessment Using Manual Muscle Testing (MMT)

Muscle strength was assessed through MMT at the end of four weeks of physiotherapy. Table 3 outlines

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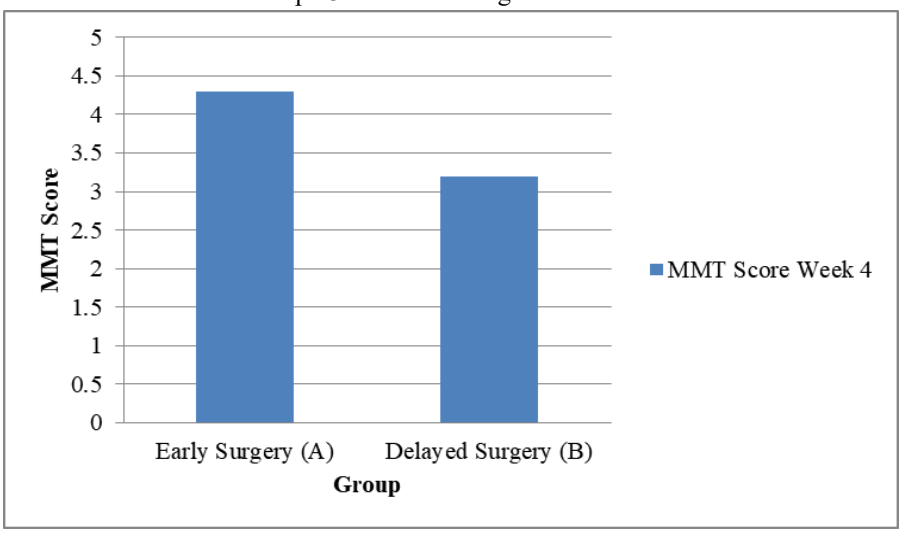
the mean MMT scores observed in both patient groups. Muscle strength was evaluated using the MMT grading scale (0 to 5).

Table 3: Comparison of Muscle Strength Scores (MMT) at Week 4

Group	Mean MMT Score (Week 4)
Early Surgery (A)	4.3 ± 0.5
Delayed Surgery (B)	3.2 ± 0.6

Graph 3: Muscle Strength at Week 4



Group (A) demonstrated better muscle recovery and higher strength levels compared to Group (B). Delayed surgery appeared to contribute to disuse atrophy and neuromuscular delay in functional restoration ($p < 0.05$).

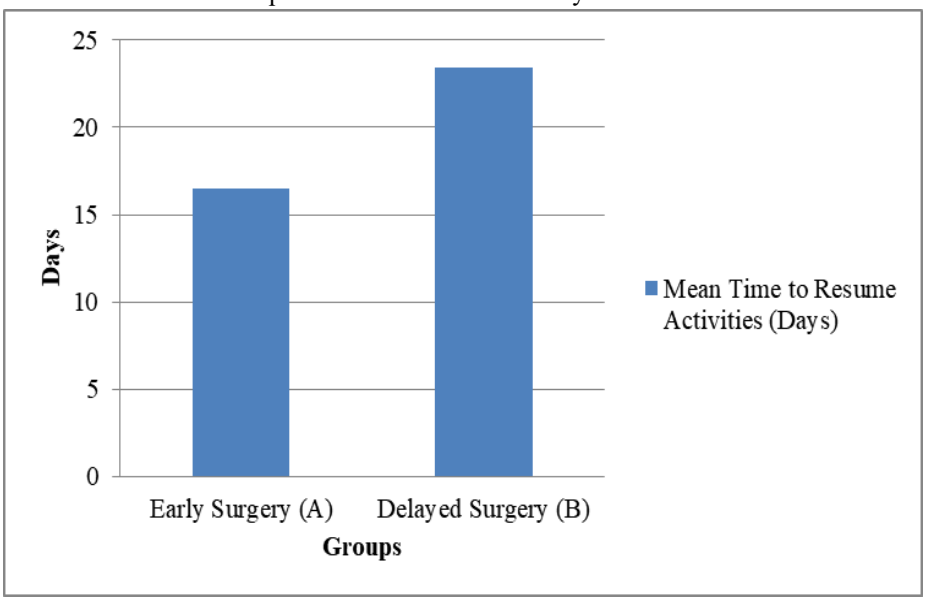
Functional Recovery Timeline

The time required to resume daily basic Patients were assessed for time taken to independently perform basic daily activities (e.g., walking, dressing, toileting) was measured in days for both groups. Table 4 provides this comparison.

Table 4: Mean Days to Resume Daily Activities

Group	Mean Time to Resume Activities (Days)
Early Surgery (A)	16.5 ± 3.2
Delayed Surgery (B)	23.4 ± 4.5

Graph 4: Time to Return to Daily Activities



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The early surgery group resumed daily activities significantly earlier than the delayed group. This suggests that surgical timing directly influences functional independence ($p < 0.01$).

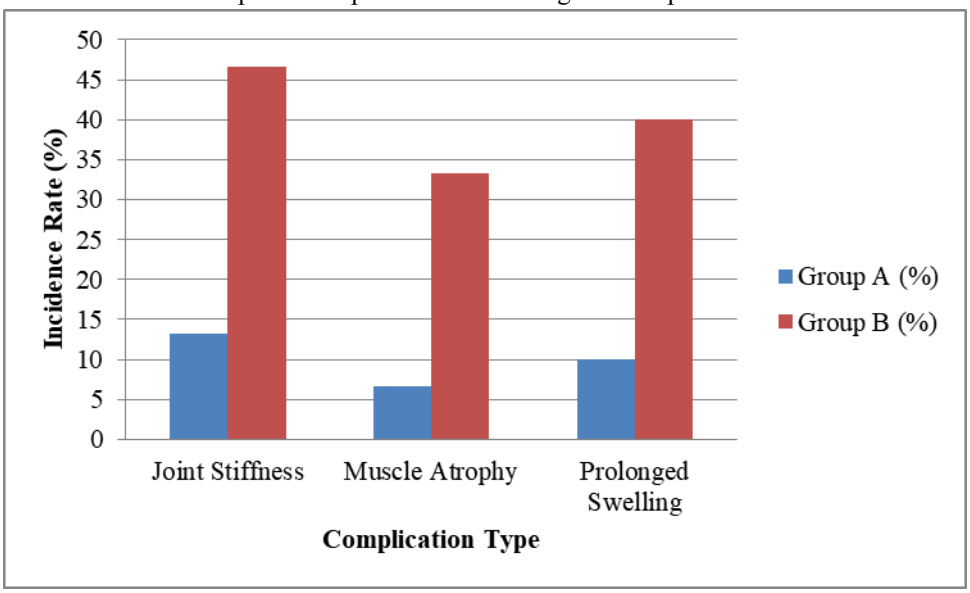
Incidence of Post-Surgical Complications

Complications such as joint stiffness, muscle atrophy, and prolonged swelling were recorded in both groups. Table 5 illustrates the percentage of patients affected in each group.

Table 5: Percentage of Post-Surgical Complications

Complication	Group A (%)	Group B (%)
Joint Stiffness	13.3%	46.6%
Muscle Atrophy	6.6%	33.3%
Prolonged Swelling	10.0%	40.0%

Graph 5: Comparison of Post-Surgical Complications



Group B had a significantly higher incidence of complications. Delayed surgery led to greater impairment in post-surgical healing and rehabilitation outcomes ($p < 0.05$).

V. DISCUSSION

This study demonstrates that the timing of orthopaedic surgery has an impact on physical recovery [19]. Surgery patients (24-72 hours) were less affected by pain, joint mobility, muscular activity, functional independence, and complication. These findings support a large amount of evidence on the clinical value of immediate orthopaedic intervention. Among the interesting results was that patients who had early surgery had significantly lower Visual Analogue Scale pain levels [20-23]. Early injury stabilisation minimises tissue damage and inflammation, minimising discomfort in this population. But postponement of surgery increases the duration of inflammation, leading to pain and suffering. Past studies have established faster pain relief and enhanced comfort in patients associated with early management.

Patients undergoing early surgery enjoyed better joint mobility, in terms of ROM. Early fixation accelerates the physiotherapy and averts joint contractures and stiffness. But the delayed surgery usually results in immobilisation and restricted movement [24]. This highlights the importance of early mobilisation to prevent disability and to promote joint functioning. MTT muscle strength outcome supports the benefits of early surgery. Prolonged inactivity preoperative disuse atrophy was the likely cause of weakening of muscles in the delayed group [25]. Early intervention will help maintain muscle mass and neuromuscular coordination, and recover faster. This is essential in preventing long-term impaired functional ability and rehabilitation.

The time needed to resume daily activities is another important factor in this research. Early surgical patients recovered independence quicker than delayed patients. Prolonged recovery can lead to prolonged work absenteeism and increased

healthcare spending, which can impact the quality of life of patients and socioeconomic factors [26-28]. The earlier group has faster functional recovery which indicates that timely surgery is not only beneficial in terms of clinical outcomes. Patients of delayed surgery had very high problems after the operation. There were more frequent joint stiffness, muscle atrophy, and chronic oedema, indicating that recovery is retarded by delays. The delay in immobilisation and unresolved injuries leads to poor result. These findings confirm previous research on delayed surgery in association with issues and increased hospitalization [29-31].

Delayed surgery is especially important in underdeveloped nations like India. Surgery can be delayed by lack of infrastructure in the health care, budget constraints, late referrals, and ignorance. This study focuses on changes in systems to reduce delays [32-34]. The enhancement of the healthcare delivery systems, accessibility, and patient knowledge can contribute to timely treatment. The study is limited with its considerable findings. The small sample (n=40) could be a limitation on generalisability. The 4 weeks follow-up might not depict the long-term healing effects. To verify and generalize these findings, larger sample sizes, multicenter, and extended follow-ups are recommended [35].

The study is a strong indication that orthopaedic surgery at an early age enhances recovery and reduces complications. It stresses the need of prompt surgery in orthopaedic treatment. By eliminating delays and optimising surgery schedule, healthcare practitioners can potentially enhance patient outcomes, rehabilitation time and quality of life.

VI. CONCLUSION

This study concludes that, in comparison to delayed surgery, early orthopaedic surgery—performed within 24 to 72 hours of injury—significantly improves physical recovery outcomes. Rapid pain relief, increased joint mobility, increased muscle strength, a quicker return to daily activities, and fewer post-operative complications were all experienced by patients who received prompt intervention. On the other hand, postponing surgical intervention resulted in increased pain, decreased functional ability, and a greater likelihood of complications like muscle atrophy and stiffness. These results underline how important surgical timing is for maximising recovery and how healthcare systems should prioritise early surgical access, particularly in settings with limited resources. In addition to improving patient outcomes, prompt orthopaedic intervention can shorten recovery times and save medical expenses.

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