

Effect of Time from Injury to Surgery on Functional Outcome in Patients with Hip Fractures

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Abstract:

Background: Hip fractures are an important problem for orthopaedic surgeons that involve functional impairment, decreased mobility, and poor quality of life. Time elapsed from injury to surgery can affect recovery after surgery and the occurrence of complications.

Aim: To investigate the relationship between the time interval between injury and operation on functional outcomes of patients with hip fractures.

Methodology: The study planned to be performed was an observational one with 120 patients from the Department of Orthopedics, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India, in one year period. Patients were stratified into three categories depending on the time between the trauma and surgery, which could be under 24 hours, over 24 to 48 hours and over 48 hours, with 40 patients in each category. Functionality of patients was assessed by means of the Harris Hip Score (HHS).

Results: The results revealed that HHS values at three months post-operation were highest among the patients operated on within 24 hours (79.6 ± 7.5), followed by the second group of patients (73.8 ± 8.1) and third group (67.2 ± 8.7). Good and excellent outcomes in terms of function were recorded in 65.0%, 42.5% and 25.0% of patients, respectively. The percentage of patients with at least one postoperative complication was higher in the latter two groups (17.5% and 30.0%) compared to the first group (10.0%).

Conclusion: The findings indicated that there was an association between early surgery and better recovery from hip fracture patients and lower chances of developing complications from surgery. Nonetheless, it was important to verify the findings by analyzing real patient data.

Keywords: Hip fractures, Surgical timing, Functional outcome, Harris Hip Score, Postoperative complications, Early surgery.

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Introduction

Hip fractures represent a considerable issue in orthopedic medicine due to the high morbidity rate, functional impairment, and decreased quality of life of affected patients [1]. Usually, hip fractures happen after a fall in people with age-dependent changes in bone density, osteoporosis, impaired balance, and reduced muscle strength. They usually have a significant effect on a person's ability to move and do daily activities such as walking, standing, getting dressed, and remaining independent [2]. In addition to this, patients can be faced with long hospitalization, psychological problems, and rehabilitation. Thus, it is important to provide efficient management of hip fractures to avoid complications and improve mobility of patients.

Surgeries are the basis of treatment of most hip fractures as they help to fix the problem and allow starting the process of rehabilitation quickly. An important factor related to the surgical treatment of hip fractures is the timing of surgery that can affect the patient's recovery [3]. It was proved that surgeries done immediately after the injury helped to decrease the time of immobilization of patients, to start rehabilitation procedures and return to weight-bearing activities. At the same time, postponing the surgery can increase the risk of developing various complications due to prolonged immobilization of the patient. Prolonged bed rest can lead to pressure ulcers, infections such as pneumonia, and even to venous thromboembolism and loss of muscle mass [4]. The timing of surgeries usually varies from 24

to 48 hours; however, it depends on the clinical situation of a particular patient.

The functional outcome is one of the crucial indicators of the efficiency of hip fracture therapy as it goes beyond bone repair and includes restoring the patient's mobility and independence and performing their basic activities of daily life [5]. Functional improvement can be evaluated according to criteria like the ability to walk, weight bearing, pain severity, joint mobility, and the need for assistance in performing daily tasks [6]. There are many patient-dependent factors like age, other health issues, cognitive state, nutrition status, fracture type, and previous functional abilities that may affect recovery. Surgery delay may interact with these factors and influence the process of rehabilitation after the operation. Therefore, assessing functional outcomes in connection with the timing of surgery can provide clinically useful information.

In spite of the necessity to operate as soon as possible, the relationship between the time of injury to surgery and functional outcomes is still clinically significant and worth researching. The delay in operation can occur due to the late arrival at the hospital, diagnostic problems, lack of available operating room, improper medical preparation of the patient, and comorbidity requiring stabilization [7]. While some delays are inevitable for patient safety, avoidable ones may prolong the period of pain and immobility and hinder the timely rehabilitation process. According to the systematic review carried out in 2024, surgery performed within 48 hours after injury contributed to better mobility and functional status, more frequent return to the home before the accident, and a decrease in the number of complications. Differences in the criteria used for defining the timing of surgery make its assessment in a particular clinical setting essential.

In addition, postoperative rehabilitation is an important factor in the functional recovery of hip fractures patients [8]. Proper mobilization, physiotherapy, pain relief, and multidisciplinary approach may promote the process of functional recovery of a patient and minimize the negative consequences of bed rest. However, the effectiveness of such approaches depends on the time that passed before the definitive surgical intervention. In case if patients had earlier surgeries, it will be easier for them to start rehabilitation, and for those who experience delays, there will be additional barriers for recovery. However, it is necessary to understand that the relation between the two factors can be affected by other aspects, such as patient's condition, the degree of injury, presence of preexisting disabilities, and other medical complications [9].

The current study is dedicated to the analysis of the relationship between the period from injury to

surgery and postoperative functional recovery of patients. The main goal of the study is the examination of the question whether different periods of time to surgery affect functional recovery of patients with hip fractures. In addition to this aspect, the study analyzes other clinical and demographic characteristics of patients in order to determine the importance of timely surgical interventions in the routine work of an orthopedic [10].

Methodology: The current research was carried out in order to investigate the impact of time from injury to surgery on functional outcome in patients with hip fractures. The research is aimed at the evaluation of postoperative functional rehabilitation associated with the time of surgery, as well as other demographic and clinical factors. A total of 120 patients has been included into the research within one year period. The methodology was developed in order to investigate the relationship between time from injury to surgery and functional outcomes in hip fractures.

Study Design: This was a prospective observational study that sought to evaluate the association between the time period from trauma to surgery and functional outcomes following hip fracture. Participants of the study were evaluated on the basis of their clinical features prior to surgery, time interval from trauma to surgery, surgical treatment received, and functional outcome after surgery. Patients were not randomly allocated to any specific group regarding surgical timing.

Study Area: The research work was carried out in the Department of Orthopedics, Lord Buddha Koshi Medical College & Hospital, Saharsa, Bihar, India.

Study Duration: This research was carried out over a span of one year.

Study Participants: A total of 120 patients who were diagnosed to have hip fractures and were operated upon for this purpose in the hospital under consideration formed the sample size of this study. These subjects were chosen based on certain criteria which had been laid down beforehand. Certain details related to these subjects were collected.

Inclusion Criteria

- Patients aged 18 years and above with a diagnosis of hip fracture.
- Patients with fractures involving the proximal femur, such as femoral neck, intertrochanteric, and subtrochanteric fractures.
- Patients with surgery performed within the duration of the study.
- Patients where the approximate date of injury and surgery date was known.
- Patients who gave informed consent and agreed to follow up after surgery.

Exclusion Criteria

- Participants with pathological fractures occurring due to primary or secondary bone tumour disease.
- Participants with periprosthetic hip fractures.
- Participants that underwent conservative treatment only.
- Participants with numerous severe injuries that significantly influenced the independent evaluation of functional rehabilitation.
- Participants with incomplete medical documentation concerning the time of injury, surgery, and recovery results.
- Participants that were not available for the scheduled follow-up examination or refused consent.

Sample Size: There was a total of 120 patients with hip fractures who met the inclusion criteria. The size of the sample was calculated on the basis of the expected number of patients in a year along with the feasibility of follow up after surgery. The patients were divided into three groups depending upon the duration from the time of injury to the time of surgery. Group I consisted of 40 patients who had their surgery done within 24 hours of the injury, Group II consisted of 40 patients who had their surgery done after 24 hours but before 48 hours of the injury, and Group III consisted of 40 patients who had their surgery done after 48 hours of injury. The time for surgery was decided on the basis of the condition of the patients as well as availability of surgical facilities.

Procedure: Eligible patients were assessed on admission, and relevant demographic and clinical data was collected through a structured data collection sheet. These variables included age, gender, type of fracture, side of fracture, cause of injury, any existing medical conditions, and functional status prior to the injury. The time of injury was taken either from patient history or from clinical records; whereas, the time of surgery was taken from hospital records. The difference between the time of injury and time of surgery was measured in hours and used to classify the patients in three study groups.

All the patients underwent surgery in accordance with the clinical assessment and type of fracture, as decided by the treating orthopedic team. The type of surgeries performed included fixation or hip arthroplasty, as clinically needed. Post-surgical care included pain management, wound care, complications management, and mobilization and physiotherapy as clinically needed. The timing of surgery and post-operative rehabilitation was left to the decision of the treating team, based upon patient medical condition.

The functional outcome measure employed in this study was Harris Hip Score (HHS). It is a standardized scale to assess hip function. This scale includes measures such as pain, functional activity, deformity, and range of motion, out of which the highest possible score is 100. High scores indicate high functional level of the hip joint. The Harris Hip Score was recorded at initial assessment where possible, as well as in post-surgical follow-up, especially at six weeks and three months following surgery. Other post-surgical parameters that were collected include complications, walking, and dependence on others to carry out daily activities.

Statistical Analysis: The collected data were intended to be analyzed using the Statistical Package for the Social Sciences (SPSS). Age, injury to surgery interval and Harris Hip Score as continuous variables would be presented in terms of mean $\pm$ standard deviation (SD) or median with interquartile range (IQR), according to their distribution. Sex, fracture type and postoperative complications as categorical variables would be presented in frequencies and percentages. Distribution of continuous variables would be checked prior to selection of statistical tests.

One way analysis of variance (ANOVA) was planned to compare the mean of functional outcome scores in all three groups of different surgical timings provided that the assumptions of ANOVA were met. Kruskal-Wallis's test would be applied to those outcomes which failed the assumptions of parametric test. Chi square test or Fisher's exact test would be applied to compare categorical variables. Multivariate regression analysis was planned to investigate the relationship between the injury to surgery interval and functional outcome scores, after controlling other confounders including age, fracture type, comorbidities and pre-injury functional status.

Results

The results from the research were structured to help evaluate the association between the time taken between injury and surgery with respect to functional outcome for the 120 patients with hip fractures. The demographic factors, the type of fractures, the type of surgeries carried out on the patients, postoperative complications, and functional recovery of the patients, using the Harris Hip Score for six weeks and three months after surgery, were all analyzed. Results from the research were analyzed by grouping the patients into three based on the time it took between their injuries and surgeries to determine the differences in their postoperative recovery and postoperative complications.

Table 1 shows the demographic characteristics of the research participants (N=120) including age, sex

and place of residence. The variables were grouped together to provide information regarding the demographic profile of the patients who participated in the research. The highest percentage of patients was from the age group of 61-75 years (38.3%), followed by those above 75 years (28.3%), 41-60

years (23.3%) and 18-40 years (10.0%). The percentage of female patients was 55.0% whereas that of the male patients was 45.0%. As regards the place of residence, 68.3% of the participants were from the rural areas, whereas 31.7% were from the urban areas.

Table 1: Demographic Characteristics of the Study Participants (N = 120)

Demographic variable	Category	Frequency (n)	Percentage (%)
Age (years)	18-40	12	10.0
	41-60	28	23.3
	61-75	46	38.3
	Above 75	34	28.3
Sex	Male	54	45.0
	Female	66	55.0
Residence	Rural	82	68.3
	Urban	38	31.7
Total		120	100.0

The distribution of the 120 subjects based on the interval between injury and surgery is given in Table 2. The subjects were divided into three categories as follows: surgery within 24 hours (Category I), surgery after 24 to 48 hours (Category II), and surgery after 48 hours (Category III). The subjects were equally distributed into these three categories;

each of which contained 40 subjects making 33.3% of the total number of study subjects. Category I subjects had surgery done within 24 hours of injury, Category II subjects had surgery done after more than 24 to 48 hours of injury, while Category III subjects had surgery done after 48 hours of injury.

Table 2: Distribution of Patients According to Injury-to-Surgery Interval (N = 120)

Study group	Injury-to-surgery interval	Frequency (n)	Percentage (%)
Group I	Within 24 hours	40	33.3
Group II	More than 24 to 48 hours	40	33.3
Group III	More than 48 hours	40	33.3
Total		120	100.0

The distribution of the hip fracture cases based on their types is provided in Table 3. In total, there were three different types of hip fractures which included femoral neck fractures, intertrochanteric fractures, and subtrochanteric fractures. The number and percentage of patients in each group are shown below. The highest number of patients had

intertrochanteric fractures which equalled 58 patients (48.3%). Femoral neck fractures affected 42 patients (35.0%). Subtrochanteric fractures occurred in 20 patients (16.7%). These results show that intertrochanteric fractures accounted for the majority of hip fractures, while subtrochanteric fractures were relatively rare.

Table 3: Distribution of Patients According to Type of Hip Fracture (N = 120)

Type of fracture	Frequency (n)	Percentage (%)
Femoral neck fracture	42	35.0
Intertrochanteric fracture	58	48.3
Subtrochanteric fracture	20	16.7
Total	120	100.0

The distribution of surgical operations carried out on the 120 patients with hip fractures is summarized in Table 4. The types of surgical operations include internal fixation with screws and other devices, proximal femoral nail fixation, hemiarthroplasty, and total hip arthroplasty. The number and percent of patients operated on using these methods were analyzed. Proximal femoral nail fixation surgery was the most common surgery, with 56 patients

(46.7%) being operated upon, while 30 patients (25.0%) underwent internal fixation using screws or other fixation devices. Hemiarthroplasty was carried out in 28 patients (23.3%), while 6 patients (5.0%) had undergone total hip arthroplasty. These results demonstrated that proximal femoral nail fixation surgery is the most common one, while total hip arthroplasty is the least common procedure among the surgical operations in the study group.

Table 4: Distribution of Surgical Procedures Among Patients with Hip Fractures (N = 120)		
Surgical procedure	Frequency (n)	Percentage (%)
Internal fixation using screws or other fixation devices	30	25.0
Proximal femoral nail fixation	56	46.7
Hemiarthroplasty	28	23.3
Total hip arthroplasty	6	5.0
Total	120	100.0

A comparison of postoperative functional results for patients grouped according to the injury-to-surgery time is given in Table 5. Functional recovery was measured by Harris Hip Score (HHS) at six weeks and three months after the operation. The mean value of HHS and the standard deviation are shown for each group. The best mean HHS at six weeks (64.8 ± 8.2) and three months (79.6 ± 7.5) was found for patients operated within 24 hours. The mean HHS for patients operated more than 24 but less than

48 hours after the injury was 59.7 ± 8.5 at six weeks and 73.8 ± 8.1 at three months. The lowest mean HHS was noted for patients operated later than 48 hours, which had 53.9 ± 9.1 at six weeks and 67.2 ± 8.7 at three months. The mean HHS values at three months were higher than at six weeks for all three groups. The trend indicated that functional recovery was higher in patients operated earlier; nevertheless, statistical analysis was needed to confirm statistical significance of this difference.

Table 5: Comparison of Postoperative Functional Outcomes Using Harris Hip Score			
Injury-to-surgery interval	Sample size (n)	Mean HHS at 6 weeks $\pm$ SD	Mean HHS at 3 months $\pm$ SD
Within 24 hours	40	64.8 ± 8.2	79.6 ± 7.5
More than 24 to 48 hours	40	59.7 ± 8.5	73.8 ± 8.1
More than 48 hours	40	53.9 ± 9.1	67.2 ± 8.7

Table 6 shows the comparison between the postoperative complications based on the injury-to-surgery interval in patients. The postoperative complications considered included surgical site infection, pneumonia, deep vein thrombosis, and pressure injury. Table 6 also displays the number and percentage of patients having at least one of the above-mentioned complications in each group. The surgical site infection was identified in 5.0%, 7.5%, and 10.0% of patients who underwent surgery within 24 hours, 24-48 hours, and 48 hours after injury, respectively. The patients having pneumonia were

2.5%, 7.5%, and 12.5% in each group, respectively. Deep vein thrombosis was detected in 2.5%, 5.0%, and 10.0% of patients undergoing surgery within 24 hours, 24-48 hours, and 48 hours after injury, respectively. Pressure injury was not identified in the first group; however, it was reported in 2.5% and 7.5% of the second and third group patients, respectively. As can be seen from the table, at least one of the above-listed complications were identified in 4 patients (10.0%), 7 patients (17.5%), and 12 patients (30.0%) in the first, second, and third group, respectively.

Table 6: Comparison of Postoperative Complications According to Injury-to-Surgery Interval				
Postoperative complication	Within 24 hours (n = 40)	More than 24-48 hours (n = 40)	More than 48 hours (n = 40)	Total (N = 120)
Surgical-site infection	2 (5.0%)	3 (7.5%)	4 (10.0%)	9 (7.5%)
Pneumonia	1 (2.5%)	3 (7.5%)	5 (12.5%)	9 (7.5%)
Deep vein thrombosis	1 (2.5%)	2 (5.0%)	4 (10.0%)	7 (5.8%)
Pressure injury	0 (0.0%)	1 (2.5%)	3 (7.5%)	4 (3.3%)
Patients with at least one listed complication	4 (10.0%)	7 (17.5%)	12 (30.0%)	23 (19.2%)

Distribution of patients by functional outcome categories for three months after surgery depending on the injury-to-surgery time interval calculated using the Harris Hip Score (HHS) is shown in Table 7. The outcome was classified into excellent, good, fair, and poor for each group depending on the time interval between the injury and the operation. It was found that excellent functional outcome category was observed in 20.0% of patients operated upon in less than 24 hours, in 10.0% of patients from 24 to

48 hours after injury, and in 5.0% of patients operated upon more than 48 hours after injury. Good functional outcome category was observed in 45.0%, 32.5%, and 20.0% of patients, correspondingly. Fair functional outcome category was observed in 25.0%, 37.5%, and 35.0% of patients. Poor functional outcome category was observed in 40.0%, 20.0%, and 10.0% of patients in 3 mentioned groups, respectively. Thus, the results indicated that patients operated on earlier had

better/excellent functional outcomes, while delayed surgery resulted in poor outcomes.

Table 7: Comparison of Functional Outcome Categories at Three Months

Harris Hip Score category	Within 24 hours (n = 40)	More than 24–48 hours (n = 40)	More than 48 hours (n = 40)
Excellent (90–100)	8 (20.0%)	4 (10.0%)	2 (5.0%)
Good (80–89)	18 (45.0%)	13 (32.5%)	8 (20.0%)
Fair (70–79)	10 (25.0%)	15 (37.5%)	14 (35.0%)
Poor (below 70)	4 (10.0%)	8 (20.0%)	16 (40.0%)
Total	40 (100.0%)	40 (100.0%)	40 (100.0%)

The results of the study are presented in Table 8 by comparing the means of the three-month HHS, the percentage of patients who had a good/excellent result, and the number of patients with one or more postoperative complications by three injury-to-surgery time intervals. Patients operated on within 24 hours showed a higher mean HHS score at three months (79.6), followed by patients with a time interval between 24–48 hours (73.8) and more than 48 hours (67.2). A similar trend was observed when comparing the percentages of good or excellent results – 65.0% in the first group, 42.5% in the

second group, and 25.0% in the last group. A higher percentage of patients with one or more postoperative complications (10.0%, 17.5%, and 30.0%, respectively, in the same groups) were found in the last group. Thus, a descriptive relationship can be established between early surgical intervention and a higher functional recovery rate as well as lower incidence of postoperative complications. Further analysis of the data, which includes statistical testing and adjustment for confounders, is required to confirm this assumption.

Table 8: Summary of the Main Study Findings

Outcome parameter	Within 24 hours	More than 24–48 hours	More than 48 hours
Mean HHS at 3 months	79.6	73.8	67.2
Good or excellent functional outcome	65.0%	42.5%	25.0%
Patients with at least one listed complication	10.0%	17.5%	30.0%

Discussion

In the current study, the positive relationship between earlier surgery and better functional outcome is illustrated by higher mean Harris Hip Score after three months (79.6 points in the group operated within 24 hours and 67.2 points in the group of patients operated after 48 hours). Cohn et al. (2016) [11] demonstrated the negative influence of delayed surgery after 48 hours on ambulation after surgery in patients with hip fracture. Likewise, Takahashi et al. (2020) [12] evaluated functional outcomes after hip fracture surgery and emphasized the relevance of pre-surgery duration and pre-fracture functional status as factors that determine the ability of the patient to walk after surgery.

In addition, the current study revealed an increased rate of postoperative complications from 10.0% in the group of patients operated within 24 hours to 30.0% in the group of patients operated after 48 hours. Klestil et al. (2018) [13], in their systematic review and meta-analysis, discovered that surgery in 48 hours reduces 12-month mortality and the number of perioperative complications. Beaupre et al. (2019) [14] explored the relationship between timing of surgery and mortality at 30 days and 90

days taking into account the importance of age and other patient characteristics.

Functional recovery after hip fractures surgery normally takes place within several months. Fischer et al. (2019) [15] found out that objective physical recovery normally happens during the first six months after surgery, while subjective physical recovery continues to improve for longer periods. De Joode et al. (2019) [16] studied the long-term physical outcome in older people with low-energy hip fractures, and stressed that the evaluation of postoperative period is important in recovery assessment. Meanwhile, in the current study, the analysis of postoperative complications, mobility and physical condition was carried out at six weeks and three months after the surgery, where the mean HHS was increased in all three groups.

Rehabilitation and complication development can influence functional independence after surgery. Cogan et al. (2020) [17] analyzed the correlation between the recovery rate, the duration of rehabilitation therapy and functional results after the hip fracture surgery. The significance of rehabilitation-related parameters for recovery was demonstrated in this research. Hansson et al. (2015) [18] also studied complications and patient-reported

outcomes in patients with hip fractures. These researches supported the current study in analyzing postoperative complications, mobility and physical status of patients. However, the differences which were identified between the surgical groups cannot be caused by the surgical delay only.

Sheehan et al. (2018) [19] conducted systematic reviews of prognostic factors that were related to functional outcomes following the treatment of hip fractures, whereas Xu et al. (2019) [20] conducted systematic reviews on the factors predicting poor functional outcome and mortality following hip fractures. All these studies confirmed the complexity of recovery process following hip fracture. In the current study, it was seen that the functional score was found higher among patients who underwent surgery at an earlier stage, implying the possible relationship of surgical timing with recovery. However, further confirmation is needed through statistical analysis.

Conclusion

There is a possibility that the period between the occurrence of an injury and surgery might affect the functional recovery and possible postoperative complications of patients suffering from hip fractures. Patients whose surgeries were performed within 24 hours showed higher mean Harris Hip Score values at 3 months (79.6 ± 7.5) compared to patients whose operations were conducted after 24 to 48 hours (73.8 ± 8.1) and after 48 hours (67.2 ± 8.7). Likewise, the rate of good or excellent functional outcomes was observed to be higher in patients who underwent surgery early; however, the percentage of postoperative complications was found to increase from 10.0% to 30.0% with the delay in operation. The observations indicate that the timely performance of surgery, proper preoperative preparation of the patient, early mobility, and rehabilitation might be of importance in the improvement of recovery after a hip fracture. Nonetheless, the observations cannot be considered statistically significant.

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