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Research Article

Hip Fracture: Risk Factors of Delay and Appropriate Timing to Surgery

Ahmad K Abdallah* and Riad Fakih

Department of Orthopedic Surgery, Makassed General Hospital, Beirut, Lebanon

***Corresponding Author:** Ahmad K Abdallah, Department of Orthopedic Surgery, Makassed General Hospital, Beirut, Lebanon.

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Abstract

Background: "Patients with a hip fracture may be appropriately delayed for surgery as they require optimization or clinical interventions to treat acute medical illnesses" [12]. "Other patients are inappropriately delayed due to hospital factors" [3,10]. Effective admission and surgery in due time is well known as the best management course for these patients.

It is still not clear that the best time for the operation of hip fractures in older patients. We are aiming to examine the effect of the timing of surgical intervention on the occurrence of post-operative complications, recovery of weight bearing ability, and total hospitalization time.

Objectives: The goal of this study is to (1) identify the occurence of surgical delay in hip fractures, (2) evaluate the time point of surgical delay raises the risk of complications for patients, as well as recovery of weight bearing ability, total hospitalization time and (3) investigate the relation between the frequency of post-operative complications, mortality, quality of life and the timing of surgical repair.

Methods: A retrospective cohort study was conducted on patients with main diagnosis of hip fracture (femur neck and peritrochenteric fractures), aged 60 years and older, who underwent surgery in Makassed General Hospital between January 2010 and December 2015.

They were divided into two groups: an early surgery group (surgery done within 1 day after admission) and a delayed surgery group (surgery done after 1 day).

Clinical parameters that were analyzed included: the age of patients, their gender, their pre-injury ambulatory ability, the occurrence of admission during public holiday, fracture site and type, blood tests and urinalysis at admission, and chest radiography, electrocardiography, number of systemic chronic diseases, dementia, surgical modality, blood transfusion, length of hospital stay, ambulatory ability at discharge, and hospital death.

The Harris Hip Score system and Oxford Hip Score system were used to measure the physical and clinical outcome after 2 years follow up.

Results: Among 88 patients treated for hip fracture, 49 patients (55.6%) received early surgery, and 39 patients (44.4%) received late surgery. Multivariate analysis identified that admission during public holiday, electrocardiographic abnormalities, blood tests abnormalities, dementia, ambulatory discharge status, and length of hospital stay as significant independent factors.

Conclusion: Surgical delay of more than one day after admission in the setting of hip fractures is common and put patients at an increased risk of complications. The causes of surgical delay as cleared were admission during public holiday, ECG and blood tests abnormalities, and dementia. On the other hand, early surgery results in shorter hospital stay, lower incidence of dementia, and better ambulatory status after discharge. In addition, hip scoring showed better results in patients who underwent early surgery. It is recommending surgical intervention within 24 hours from hospital admission when possible. Healthcare systems can utilize these non-modifiable risk factors when performing quality assessment and cost accounting.

Keywords: Hip Fracture; Arthroplasty; Complications

Introduction

Fractures of the hip are common with more than 1.6 million happening yearly worldwide [5]. With an aging population, hip fractures are expected to reach 7 million per year in the next following decades [15] and will be an increasing area of concern and resource allocation in the coming years.

"The most appropriate surgical timing for the treatment of fragility fractures of proximal femur is still a matter of debate, even if they represent the most common fractures worldwide" [7]. There are clashing opinions about the most appropriate timing of surgery to achieve the best functional outcomes with the lower rate of clinical outcomes, optimizing at the same time the economic resources. Theoretically speaking, advantages of a delayed surgery are to achieve a stabilization of any systemic disease and to improve medical imbalances, decreasing perioperative risks of mortality and morbidity. On the other hand, the possible adverse effects are an increased risk for postoperative complications, longer hospital stays, a slow recovery, and an impact on mortality [9]. An early timing of surgery may lead to an early mobilization of the patients, decreasing the risks of disability and hospitalization, and enabling an early home discharge. Moreover, it will allow a decrease in the use of analgesics. All this is part of the "framework of frail elderly", increasingly requiring a global "orthogeriatric approach", as widely discussed [18].

The purpose of this retrospective study is to assess the influence of the surgical timing, from admission to surgery, on the management of proximal femur fractures at a single institution by the analysis of specific objectives as clinical outcomes, rate of complications, mortality at one year after surgery, perioperative morbidity, time of postoperative hospital stay, onset of any disabilities, and the patients' loss of autonomy.

Methods

We performed a retrospective analysis of data from the surgical database at our hospital. 88 patients, aged 60 years and above, between January 2010 and December 2015, who underwent surgery were enrolled in this study. The hospital where this study takes place is a self-contained regional hospital with an orthopedic department and an in-hospital rehabilitation facility, which provides care for patients with acute injury.

The subjects comprised 31 men (35.22%) and 57 women (64.77%). The ages at injury ranged from 60 to 101 years (mean 79.6 years). The fracture type was femoral neck fracture in 85 patients (96.59%) and trochanteric fracture in 3 patients (3.41%). The treatment strategy for hip fracture is to perform surgery as early as one day post admission.

In principles, patients who underwent hip arthroplasty were included in the study to eliminate the effect of type of surgery on the post-operative rehabilitation. The 88 patients underwent surgeries comprising Bipolar hip hemi arthroplasty in 58 (65.91%) and total hip arthroplasty in 30 (34.09%).

The populations of interest were adults (males and females) aged 60 years or older undergoing surgery for first time acute intra- and extracapsular hip fracture, were ambulating freely before the incidence of the fracture and allowed for full weight bearing post-operatively. Exclusion criteria are: patients who underwent hip surgeries for non-fracture causes, pathological hip fractures, aged below 60 years, had fracture for more than 24 hours before admission, polytraumatized patients who had other site of the body injured or other fractures, patients who were not available for follow up after 2 years' post-operative, suffered a previous hip fracture or surgeries.

The subjects were divided into an early surgery group in which surgery was conducted on the same day or on the next day of admission (0 to 24 hours), and a delayed surgery group in which surgery was conducted later (more than 24 hours). We selected surgery up to day 1 after admission as early surgery because in most studies, early intervention is defined as surgery performed within 24 h after admission or injury [14].

Next, we analyzed 19 parameters as potential factors that delay surgery or affect postsurgical outcome: age at admission, gender, height and weight, day of admission (admission during weekend/public holiday), results of blood tests and urine analysis at admission, chest radiographic abnormalities, electrocardiographic abnormalities, number of systemic chronic diseases, pre-injury ambulatory ability, fracture site (right or left), fracture type (femur neck or peritrochenteric), surgical modality (bipolar hemi arthroplasty or total hip), status of dementia, status of blood transfusion, length of hospital stay, ambulatory ability at discharge, and hospital death (Table 1).

1	Age (years)	60 and more
2	Gender	Male or female
3	Height	In cm
4	Weight	In kg
5	Day of admission	Weekend/public holiday
6	Blood tests	Normal; abnormal INR; abnormal chemistry; abnormal INR and chemistry; abnormal CBCD, INR and chemistry
7	Urine analysis	Normal; positive WBC; positive RBC; positive WBC and RBC
8	Chest radiograph	Clear lungs; positive findings
9	Electrocardiography	Normal; abnormal findings
10	Systemic chronic diseases	Presence of systemic chronic disease and number of them
11	Pre-injury ambulatory ability	Ambulating freely, with assistance or bed ridden
12	Fracture site	Right or left hip
13	Fracture type	Femur neck or peritrochenteric
14	Surgical modality	Bipolar hip hemi-arthroplasty, total hip arthroplasty
15	Dementia	present
16	Blood transfusion	With or without
17	Hospital stay	Length in days from admission until discharge
18	Ambulatory discharge	Ambulating freely, with assistance or bed ridden
19	Hospital death	Deceased within same admission

Table 1: Parameters analyzed.

Cm: Centimeter; Kg: Kilogram; INR: International Normalized Ratio; CBCD: Complete Blood Count and Differential; WBC: White Blood Cells; RBC: Red Blood Cells

In addition, we analyzed 2 parameters as scoring system to identify the outcome on the patients after 2 years' follow-up using the Harris-hip score and oxford hip score (Table 2).

1	Harris hip score	The domains covered are pain, function, absence of deformity, and range of motion. The pain domain measures pain severity and its effect on activities and need for pain medication [1]	<70 is considered a poor result; 70-80 is considered fair, 80-90 is good, and 90-100 is an excellent result [6]
2	Oxford hip score	assesses pain (6 items) and function (6 items) of the hip in relation to daily activities such as walking, dressing, sleeping, etc.	>41 as excellent, 34-41 as good, 27-33 as fair, and <27 as poor [8]

Table 2: Scoring parameters analyzed after 2 years' follow up.

The results were collected from the attending physician's clinics and they include scores about the pain, range of motion, presence of disability and independence of the patients after 2 years from surgery.

First a univariate analysis on the above clinical factors was conducted to identify factors that differ significantly between the early surgery and delayed surgery groups. Then multivariate analysis by logistic regression was conducted using the parameters showing significant difference ($p < 0.05$) in univariate analysis as independent variables. A p-value less than 0.05 was considered statistically significant.

Results

Among 88 patients who underwent surgery for hip fracture, 49 patients (55.68%) received early surgery, and 39 patients (44.32%) received late surgery (Figure 1).

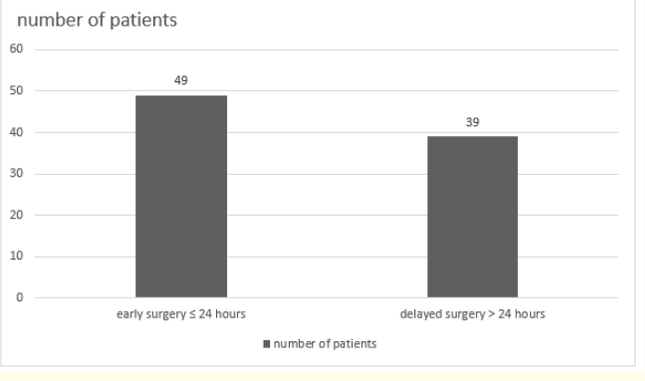

Figure 1: Number of patients in early and delayed group.

Univariate analysis showed no differences between early and delayed surgery groups in 11 parameters: age, gender, urine tests and chest radiographs at admission, presence and number of

systemic chronic diseases, pre-injury ambulatory ability, fracture site and type, choice of surgical modality, blood transfusion and hospital death (Tables 3, 4 and 5).

Number		Early operation N = 49		Delayed operation N = 39		p-value
		%	Number	%		
Age	Years	79.53 ± 7.37		79.90 ± 8.00		0.82
Gender	Male	14	28.6	17	43.6	0.14
	Female	35	71.4	22	56.4	
Height	cm	162.00 ± 6.55		161.66 ± 9.24		0.86
Weight	Kg	71.70 ± 9.95		68.86 ± 11.69		0.29
Admission during public holiday	Yes	4	8.2	20	51.3	<0.0001
Blood tests	Normal	44	89.8	27	69.2	0.04
	Normal CBCD and INR, abnormal chemistry	5	10.2	8	20.5	
	Normal CBCD, abnormal INR, normal chemistry	0	0.0	2	5.1	
	Normal CBCD, abnormal INR and chemistry	0	0.0	2	5.1	
Urine tests	Negative	35	71.4	25	64.1	0.90
	Positive white blood cells	10	20.4	10	25.6	
	Positive red blood cells	2	4.1	2	5.1	
	Positive white and red blood cells	2	4.1	2	5.1	
Chest X-Ray	Clear lungs	47	95.9	34	87.2	0.23
	Positive finding	2	4.1	5	12.8	
Electrocardiography	Normal	48	98.0	33	84.6	0.04
	Abnormal	1	2.0	6	15.4	
Number of systemic chronic diseases	Mean	1.39 ± 0.98		1.64 ± 1.18		0.28
	0	10	20.4	9	23.1	0.29
	1	17	34.7	7	17.9	
	2	15	30.6	14	35.9	
	3	7	14.3	7	17.9	
	4	0	0.0	2	5.1	

Table 3: Univariate analysis of Patients' demographic and clinical variables.

Number		Early operation N = 49		Delayed operation N = 39		p-value
		%	Number	%		
Pre-injury ambulatory ability	Ambulating freely	49	100	39	100	NA
	Needs assistance	0	0.0	0	0.0	
	Bed ridden	0	0.0	0	0.0	

Fracture site	Right	22	44.9	17	43.6	0.90
	Left	27	55.1	22	56.4	
Fracture type	Femur neck	47	95.9	38	97.4	1.00
	Peritrochenteric hip	2	4.1	1	2.6	
Surgical modality	Bipolar hip hemi arthroplasty	31	63.3	27	69.2	0.56
	Total hip arthroplasty	18	36.7	12	30.8	

Table 4: Univariate analysis of Surgery variables.

Number		**Early operation N = 49**		**Late operation N = 39**		**p-value**
		%	**Number**	**%**		
Dementia	No	46	93.9	21	53.8	<0.0001
	Pre-op	0	0.0	2	5.1	
	Post-op	3	6.1	16	41.0	
	Pre and post-op	0	0.0	0	0.0	
Blood transfusion		33	67.3	25	64.1	0.75
Ambulatory discharge	Full weight bearing	49	100.0	14	36.8	<0.0001
	Partial weight bearing	0	0.0	24	63.2	
	Non-weight bearing	0	0.0	0	0.0	
Hospital death		0	0.0	1	2.6	0.44
Length of stay	Days	5.86 ± 1.57		8.64 ± 2.03		<0.0001

Table 5: Univariate analysis of post-surgery variables.

Out of 88 patients included in this study, 24 patients were admitted during public holidays, distributed among 4 patients who underwent early surgery (8.16% out of patients who had early surgery) and 20 patients who experienced delayed surgery (51.28% out of patients who had delayed surgery) (Table 3). As well, 17 patients had abnormal blood tests finding at admission, distributed among 5 patients in early surgery group (10.20% out of early surgery population) and 12 patients in delayed surgery group (30.76% out of delayed surgery population) (Table 3). In addition, 7 patients had abnormal electrocardiographic findings, distributed among 1 patient in early surgery group (2% of early surgery population) and 6 patients in delayed surgery group (15.4% of delayed surgery population) (Table 3).

univariate analysis identified admission during weekend or public holiday (p-value <0.0001), electrographic abnormalities (p-value 0.04), blood tests abnormalities (p-value 0.04) as significant independent factors for delayed surgery.

Regarding the outcomes, 3 out of 49 patients (6.1%) who underwent early surgery and 18 out of 39 patients (46.1%) who had delayed surgery developed dementia post-op (Table 5). All patients who had early surgery were discharged on full weight bearing; but, 24 out of 39 patients (63.2%) who had delayed surgery were only able to partially bear weight (Table 4), with a p-value of <0.0001.

Regarding the length of stay, the average of days for the patients who underwent early surgery was 5.86 days (±1.57); whereas the average of days for the patients who underwent delayed surgery was 8.64 days (±2.03) with a p-value of <0.0001 (Table 5 and 6).

As noticed, patients who experienced a surgical delay (more than 24 hours after admission) were at increased risk for developing dementia (p-value <0.0001), altered ambulatory discharge ability (p-value <0.0001) and delayed length of hospital stay (p-value <0.0001) compared to those who underwent earlier surgical intervention (within 24 hours after admission) (Table 6).

Outcome variable	Early surgery	Delayed surgery
Length of the hospital stay (days)	5.86 ± 1.57	8.64 ± 2.03
Developing dementia	3 (6.1%)	18 (45.1%)
Altered ambulatory discharge	0 (0.0%)	24 (63.2%)

Table 6: Details of the outcome variables.

At 2 years' follow-up in attending physicians' clinics, a Harris hip score and oxford hip score system was filled according to questions asked to the patients and physical exams done by the attending physicians. The average Harris hip score was 88.63 (± 6.42) for the patients who underwent early surgery and was 85.53 (± 6.05) for those who had delayed surgery with a p-value measuring 0.02. on the other hand, the oxford hip score average was 38.95 (± 3.67) for early surgery patients and 34.81 (± 3.26) for delayed surgery patients with a p-value of <0.0001. The comparison between these results showed that patients who had early surgery had better scores in both Harris hip and oxford hip score, which mark a notable benefit in patients who underwent early surgery (Figure 2 and 3).

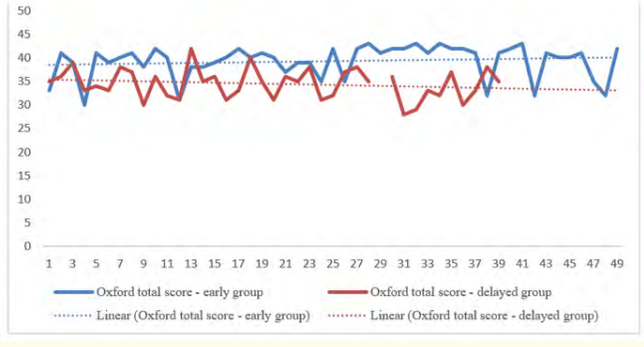

Figure 2: Difference between Oxford total score in both groups.

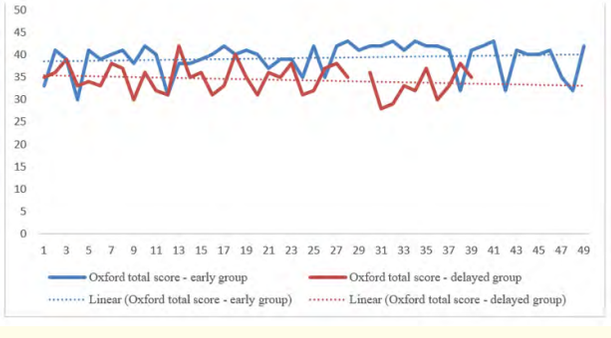

Figure 3: Difference between Harris hip score in both groups.

Finally, there was no documented hospital death for any patient in the early group, with only one documented hospital death in the delayed surgery group. The effect of surgery delay on hospital mortality is then more difficult to prove. To show a causal relationship between delayed surgery and hospital death would not be easily achievable as shown by the p-value which is 0.44.

Discussion

Proximal femur fractures are the most common injuries worldwide in the elderly people [2,4,7,19] studies dealing with this frequent clinical issues may be considered crucial, given the significant impact on patients and society. Particularly, the analysis of the factors influencing the functional outcomes is important to improve the treatment. One of the most debated factors is surely the surgical timing. Several studies have been published in the literature during the last decades with rather discordant results. Despite all the researches and studies, differing for methodologies and type of evaluations, there are still controversies about the influence of surgical timing in the postoperative results. Moreover, randomized studies with large number of patients, even if theoretically decisive, are impractical due to ethical reasons. One of the most important meta-analyses has been reported by Khan., *et al*. 2009 [9], considering the results of 52 prospective and retrospective studies: a clear discrepancy was assessed related to different methodological factors and results [9]. However, recent studies seem to identify in the early treatment the better strategy to ensure the best recovery and the lower rate of mortality and complications [16,17]. At the Authors' Institution, the early treatment of proximal femoral fractures in patients of all ages has been recently introduced, with respect to the delayed management conducted until few years ago. The need of proving preliminary outcomes of the new approach has lead the Authors to deeply analyze all the involved factors to ascertain the opportunity to switch from a delayed to an early surgery for these patients.

Patients may be appropriately delayed to surgery to enable correction of clinical instability (as distinct from stable comorbidity). However, there is no consensus on which clinical features represent appropriate delays. The clinical guideline of the UK National Institute for Health and Care Excellence suggested that patients may be appropriately delayed by the following medical conditions and treatments: anemia, anticoagulation, volume depletion, electrolyte imbalance, uncontrolled diabetes, uncontrolled heart failure, acute cardiac arrhythmia or ischemia, acute chest infection, or exacerbation of a chronic chest condition.

Further, patients may choose to delay surgery for other personal reasons. There is a need for consensus on what represent appropriate delays before surgery.

Patients admitted to care settings with less resources available such as operating room, financial and insurance clearance, specialist or laboratory test experience longer time to surgery for non-medical reasons. These potentially avoidable longer times to surgery prolong exposure to immobilized and inflammatory states which in turn can lead to potentially fatal complications. Where the surgery requires additional resources such as a surgeon with arthroplasty experience or implants not available on the shelf, the patient may be delayed further. Longer time to surgery due to resource availability may be considered inappropriate where the patient is required to wait despite being surgically ready.

The present study identified admission during public holiday, abnormal blood tests and electrocardiography as independent risk factors of surgical delay. Early mobilization is vital in the care of a patient with a hip fracture to achieve faster rehabilitation and decrease hospital stay. Therefore, decreasing the risk of delirium and post-operative complications including infections (urinary tract, chest, and surgical infections). Moreover, delaying surgery for non-medical reasons would augment the financial and health providing facilities burden on the patient and the society, which will lead to altered socioeconomic status.

These findings suggest a need to reflect on the current practice. In the future, the hospital system should work with the medical care providers to avoid delay in surgery; this will result in early surgery as it will improve the outcome of patients undergoing surgery for hip fracture.

We recommend that surgeons and healthcare systems consider implementing and testing clinical pathways that might include education of front line emergency department and triage staff, surgical co-management colleagues, and optimizing operating room staffing/availability in an effort to transition hip fracture patients to the operating room within 24 hours. Surgeons, healthcare systems and policy makers may also utilize these data when performing quality assessment and conducting cost accounting.

The weaknesses of this study include the retrospective design, future intervention studies should target these modifiable system factors for delay to ensure timely appropriate care.

Conclusion

It is considered surgical delay of more than 24 hours in the setting of hip fractures is common and confers an increased risk of postoperative complications to patients. When possible, we recommend surgical intervention within 24 hours from hospital admission in an effort to minimize risk of postoperative complications and patient morbidity and mortality. We find admission during public holiday and what it encounters of non-availability of medical or financial clearance, and altered blood tests to be modifiable risk factors for surgical delay of more than 24 hours; non-modifiable risk factors include abnormal ECG findings and clinically unstable patients. Healthcare systems can utilize our modifiable risk factors (financial clearance during public holiday) when performing quality assessment and cost accounting.

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