Early Mobilization Post–Hip Fracture Surgery

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Abstract

Introduction: Early mobilization after hip fracture surgery is a widely practiced component of postoperative care. However, there is little evidence to suggest that early mobilization post–hip fracture surgery is beneficial in reducing postoperative complications. This study aims to investigate the effect of early mobilization following hip fracture surgery on postoperative complications. **Materials and Methods:** This study retrospectively included 240 patients (female = 165, male = 75, mean age: 82.2 years) admitted to a level 1 trauma center in Adelaide, Australia, for hip fracture surgery. The effect of early mobilization on postoperative complications was assessed along with premorbid status. Subgroup analysis of patients stratified by premorbid health was subsequently analyzed to reduce confounding. **Results:** The odds of developing a complication were 1.9 times higher if the patient remained bedbound compared to mobilizing. Early mobilization was favorable to delayed mobilization. On average, complication-free patients mobilized earlier (mean [M] = 29 hours) compared to patients who experienced complications (M = 38 hours). In particular, rates of delirium was significantly reduced in patients who mobilized compared to remaining bedbound. However, premorbid status varied greatly. Early mobilizers had significantly better premorbid health than patients who remained bedbound. Overall subgroup analysis of patients with similar premorbid health showed mobilization was not associated with a reduction in complications. With an exception of patients with poor premorbid health, who experienced a reduction in complications following early mobilization. **Discussion:** In general, early mobilization was associated with the same complication rates as delayed mobilization and remaining bedbound. Patients with poor premorbid health benefited most from early mobilization with reduced complication rates. **Conclusion:** Postoperative delirium and premorbid health were better indicators of postoperative outcomes than time to mobilization.

Introduction

With an aging global population, hip fracture management has become a significant health issue.[1] Maximizing postoperative patient management is imperative to reduce postoperative complications and maximize patient outcomes.[2] Early patient mobilization is a commonly practiced technique to reduce postoperative complications.

Early mobilization following hip fracture repair is thought to be an imperative part of postoperative management. Bed rest has been associated with undesirable cardiovascular, pulmonary and urinary effects, reduced muscle tone, loss of bone mineral density, and negative psychological effects.[3-6] Specifically, early mobilization has been associated with a reduction in postoperative complications such as thromboembolism, pneumonia, wound breakdown, pressure ulcers, and delirium.[7]

There are many factors that determine a patient's ability to regain mobility following a hip fracture. Age, prefracture mobility, and participating in physiotherapy postoperatively are factors that determine a patient's ability to regain mobility.[8]

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Figure 1. Flow chart of patient exclusions.

The evidence base for early mobilization post–hip fracture repair is limited to 2 studies. A small 2006 randomized control trial of 60 patients following hip fracture surgery concluded that at day 7, patients who mobilized within 48 hours of surgery were able to walk further, required less assistance to transfer and were more likely to be discharged directly home, when compared to patients where ambulation was delayed.[9]

A retrospective study of 532 patients concluded that mobilization within 48 hours was associated with a 5.4% reduction in mortality at 6 months when compared to patients who mobilized at 8 days.[10] Major limitations of these studies are their small sample size and crude end points, respectively. This has resulted in the Australian and New Zealand Hip Fracture Guidelines stating "evidence provides some support for early mobilisation but care should be taken in its application."(p. 63)[11]

Early mobilization is also not without risks. Nursing and physiotherapy staff are often reluctant to encourage early mobilization due to concerns about increased risk of falls and patient discomfort. Early mobilization may require increased opioid dosing which has its own associated consequences.[12] It is therefore clear more research needs to be done to validate the role of early mobilization following hip fracture surgery.

In this study, the effect of mobilization on postoperative complications is examined. In particular, the effects of failing to mobilize post–hip fracture surgery and the role of early mobilization.

Materials and Methods

A retrospective review was conducted of all patients who presented to Flinders Medical Centre, Adelaide, Australia (level 1 trauma center) with a neck of femur fracture from September 2014 to June 2015. Data were collected from 318 patient files. 76 patients were excluded (Figure 1).

Data Collection

All data were collected either from the patient notes or the electronic results database. The following data were collected.

Patient mobility. Information regarding patient mobility status was well-documented by physiotherapists. Physiotherapists reviewed patients following hip fracture surgery daily as per the Flinders Medical Centre hip fracture protocol. All patients were managed via a standardized pathway. A physiotherapist reviewed the patient the day following their operation and daily thereafter. As per the Australian and New Zealand hip fracture guidelines, physiotherapists attempted mobilization of all patients within 48 hours.
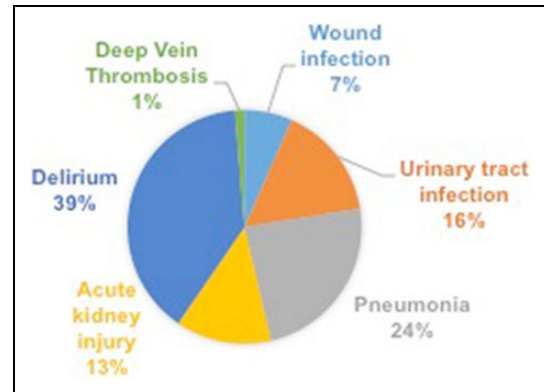

Figure 2. Distribution of postoperative complications.

Surgical approach and choice of fixation had no influence on determining when to mobilize a patient. Physiotherapists were able to delay attempting mobilization if they judged the patient to be medically unstable.

The physiotherapist recorded the patient's preoperative mobility status and current mobility status in the case notes.

Premorbid and postsurgical patient mobility status was recorded. Unfortunately, no standardized mobility index was used. Therefore, the following classification was used:

- Bedbound
- Stand with frame
- Walk with frame assisted
- Walk with frame unassisted
- Walk with stick
- Walk unassisted

The time between the operation finishing and when the physiotherapist recorded that the patient was able to safely weight bear was termed "time to mobilization."

Patients were categorized according to their postoperative mobility as either bedbound or able to mobilize. This categorization was determined at time of discharge.

Postoperative complications. The following complications were recorded:

- Urinary tract infection
- Pneumonia
- Anemia
- Wound infection
- Postoperative delirium
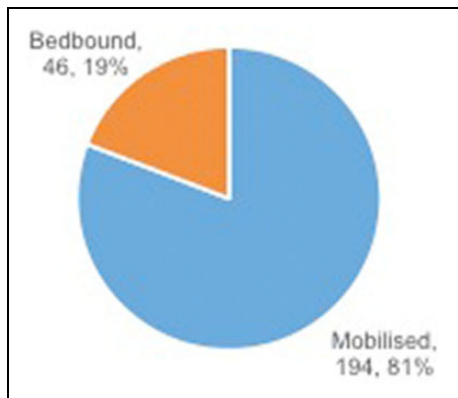- Thromboembolism
- Pressure ulcers

Figure 3. Fraction of postoperative mobility outcomes.

Patients were then categorized as complicated or uncomplicated.

Premorbid status. It had been planned to calculate the patient's premorbid status using the Charlson Comorbidity Index.[13] However the medical records had insufficient information to correctly use this index. Premorbid status was therefore determined from 3 domains: age, premorbid mobility, and comorbidities.[8]

The following comorbidities were recorded to establish each patient's premorbid status.

- type 2 diabetes
- chronic kidney disease
- congestive heart failure
- chronic liver disease
- chronic lung disease
- cerebrovascular insult
- dementia
- cancer

The total number of comorbidities for each patient was calculated. Each comorbidity was given a value of 1. That is, a patient with 3 of the above comorbidities had a comorbidity score of 3.

Data Analysis

Data were processed using IBM's SPSS statistics.

Results

Premorbid Status

Postoperative complications. Ninety-four patients experienced complications and 146 patients experienced no complications. Three patients died postoperatively and were removed. Figure 2 illustrates the distribution of postoperative complication.

Postoperative Mobility. As illustrated in Figure 3, 46 patients were unable to mobilize postoperatively during their stay in hospital and 194 were able to mobilize. Of those patients who
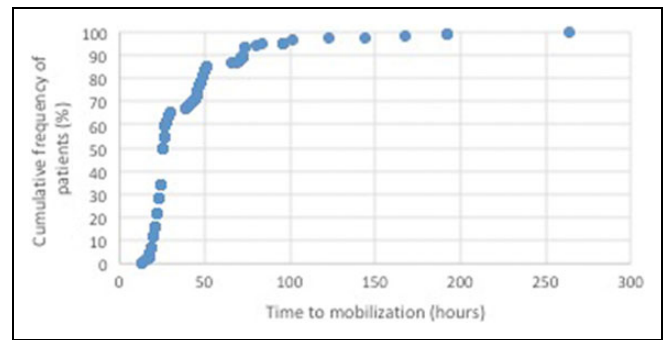

Figure 4. Cumulative frequency of mobilization time.
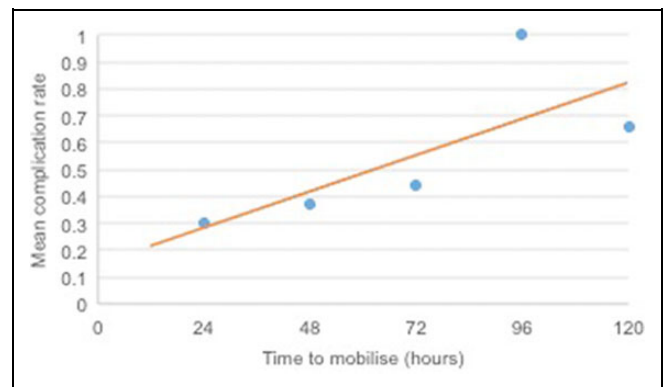

Figure 5. Time bedbound versus complications.

mobilized the mean (M) time to weight bearing was 36 hours. Figure 4 depicts the cumulative frequency of the time to mobilization.

Mobility and complications. The odds of developing a complication differed significantly between patients who mobilized (36%) and patients who remained bedbound (52%; odds ratio [OR] = 1.9, 95% confidence interval [CI] = 1.1-3.7; $P = .044$).

The complication rate also increased the longer it took the patient to mobilize (Figure 5). Post–log transformation, there was a significant difference in the time to mobilization for complication-free patients (M = 28.7 hours, standard deviation [SD] = 1.6) compared to patients who developed complications (M = 37.3 hours, SD = 1.9, $t[190] = 3.23$, $P = .001$).

In terms of specific complications, delirium was the only complication that was statistically significantly reduced in patients who mobilized compared to remaining bedbound (Figure 6).

The rates of wound infections, urinary tract infections, and pneumonia did not differ between patients who mobilized and patients who remained bedbound. Pressure sores (N = 0) and thromboembolisms (N = 2) were not analyzed due to insignificant occurrence.

Postoperative delirium. In this study, 24% of patients developed delirium postoperatively. The odds of developing delirium differed significantly between patients who mobilized (22%) and
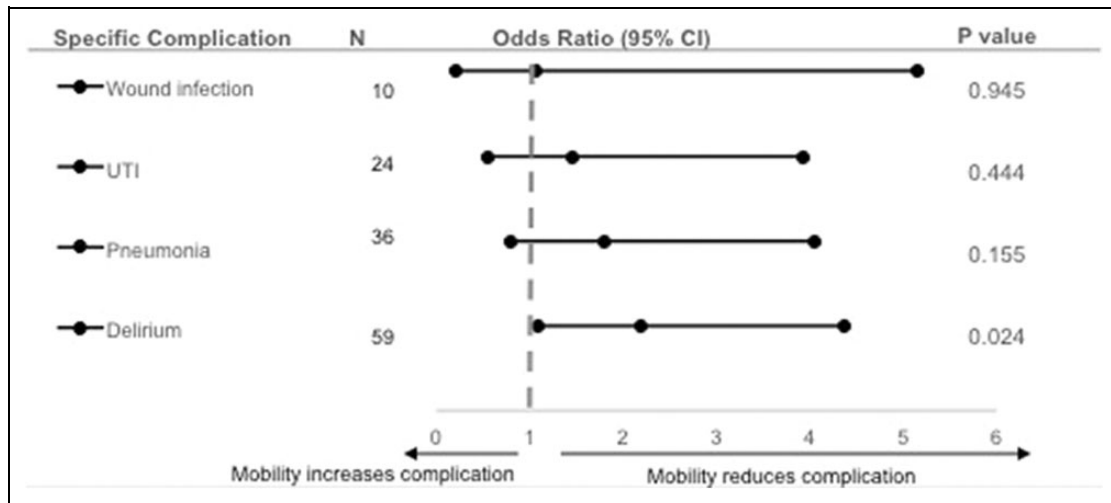
Figure 6. Odds ratios of mobilizing and developing a complication compared to remaining bedbound and developing a complication.

patients who remained bedbound (37%; OR = 2.2, 95% CI = 1.1-4.4; P = .024).

For patients who developed postoperative delirium, the odds of developing another postoperative complication was higher (39%) compared to patients who did not develop postoperative delirium (22%; OR = 2.3, 95% CI = 1.2-4.4; P = .008).

Subgroup Analysis

Due to the large variation in premorbid status between the postoperative mobilization groups as illustrated in Table 1, it is difficult to assess the relationship between postoperative mobilization and postoperative complications with certainty, due to premorbid confounding factors.

To overcome this, the relationship between mobilization and postoperative complications has also been assessed by subgroup analysis. Three subgroups have been stratified in terms of age, comorbidities, and premorbid mobility level.

The subgroups have the following characteristics.

Good premorbid health. Younger than 85 years old, 1 or no comorbidities, and mobilizers independently without an aid.

Moderate premorbid health. Between 75 and 90 years old, 1 or 2 comorbidities, and mobilizers with no aid, a stick, or a frame unassisted. Excluded if already included in good premorbid health group (N = 3).

Poor premorbid health. Older than 80 years old, greater than 2 comorbidities, mobilizers with either a frame with assistance, is only able to stand with a frame or is bedbound.

Mobility—Subgroup Analysis

For all 3 subgroups, no significant difference in complication rates was established between patients who remained bedbound and mobilized postoperatively (Table 2). As previously reported in the main group analysis, the worse the premorbid health of the subgroup, the higher the complication rate.

In terms of the patients from the subgroups that mobilized postoperatively (Table 3). In the good and moderate premorbid health subgroup, there was no significant difference in the time to mobilization between patients who experienced complications and patients who did not. Patients in the poor health subgroup who did not experience a complication on average mobilized earlier (median = 24 hours) than patients who experienced complications (median = 49 hours), P = .044.

Discussion

In this study, the effect of mobilization on hip fracture surgery complication rates was measured. The results of the main group analysis illustrated that failing to mobilize was associated with a 1.9 times increase in the risk of developing a complication. Bedbound patients had a complication rate of 52%, whereas patients who mobilized had a complication rate of 36%. Furthermore early mobilization was associated with a lower the risk of complications. The M time to mobilization for complication-free patients was 29 hours compared to 38 hours for patients who had complications.

However, it is difficult to interpret these results due to the variation in premorbid health between groups. Premorbid health as characterized by age, comorbidities, and prefracture mobility differed greatly between patients who remained bedbound, mobilized late, and mobilized early.

Patients who mobilized early (<24 hours) had the best premorbid health; Followed by patients who mobilized late (>24 hours). Patients who failed to mobilize had the worse premorbid health. Early mobilizers (<24 hours) on average were younger, had fewer comorbidities and better premorbid mobility compared to patients who were slow or unable to mobilize postoperatively. It is clear these premorbid factors partly contributed to the increaseped rates of complications

Table 1. Patient Demographics.

Characteristic	Bedbound	Delayed Mobilization (>24 hours)	Early Mobilization (<24 hours)	Total	P Value
Number of patients (%)	48 (20%)	95 (40%)	97 (40%)	240	
Sex, % (N)					
Male	33% (16)	32% (30)	30% (29)	31% (75)	.913[a]
Female	67% (32)	68% (65)	70% (68)	69% (165)	
Mean age (years)	86	84	78	82	.0001[b]
Mean comorbidities	2.44	1.31	0.86	1.36	.0001[b]
Premorbid mobility status, % (N)					
Bedbound	21% (10)	0% (0)	1% (1)	4.6% (11)	.0001[a]
Standing with frame	4% (2)	0% (0)	0% (0)	1% (2)	
Walking with frame assisted	17% (8)	11% (11)	8% (8)	11% (27)	
Walking with frame unassisted	31% (15)	37% (36)	22% (21)	31% (72)	
Walking with stick	6% (3)	16% (15)	15% (14)	13% (32)	
Walking unassisted	21% (10)	36% (35)	54% (51)	40% (96)	

Abbreviation: ANOVA, analysis of variance.
[a]Analyzed using χ^2 test.
[b]Analyzed using 1-way ANOVA.

Table 2. Subgroup Comparison of Complication Rates Between Patients Who Remained Bedbound and Mobilized.

		Bedbound		Ambulatory			
Premorbid Health	N	N	Complication Rate	N	Complication Rate	Odds Ratio (95% CI)[a]	P Value[b]
Good	43	2	0.50	41	0.27	0.367 (0.021-6.381)	.476
Moderate	46	8	0.25	38	0.29	1.222 (0.213-7.013)	.822
Poor	41	12	0.42	29	0.59	1.983 (0.507-7.766)	.322

Abbreviation: CI, confidence interval.
[a]Odds ratio of developing a complication comparing mobilization to remaining bed bound.
[b]Analyzed using χ^2 test.

Table 3. Subgroup Comparison of Time to Mobilization of Patients Who Mobilized in Terms of Complications..

			No Complication			Complication			
Premorbid Health	N	N	Median Time to Mobilization (hours)	Minimum Time to Mobilization (hours)	Maximum Time to Mobilization (hours)	N	Median Time to Mobilization (hours)	Minimum Time to Mobilization (hours)	Maximum Time to Mobilization (hours)	P Value[a]
Good	41	30	23	13	51	11	23	15	72	.275
Moderate	38	26	24	19	123	12	26	17	101	.504
Poor	29	12	24	16	71	17	49	21	101	.044

[a]Analyzed using χ^2 test.

among the patients who were slow or failed to mobilize postoperatively.

To eliminate confounding bias, a subgroup analysis was performed comparing patients of similar premorbid health. Patients were grouped into 3 subgroups: good health, moderate health, and poor health. Analysis of these subgroups found that neither mobilization nor early mobilization had any impact on postoperative complications. There was, however, an exception for individuals in the poor health subgroup. With complication-free patients in this subgroup mobilizing earlier than patients who developed a complication.

The juxtaposition between the results of the main group analysis and the subgroup analysis suggests that premorbid health rather than mobilization is a better indicator for determining postoperative complications.

Subgroup analysis of specific complications determined only rates of delirium was reduced in patients who mobilized. All patients who developed delirium were managed via a standardized protocol involving nonpharmacological and pharmacological interventions. As part of this protocol, delirium inducing agents such as opioids were avoided. By avoiding opioids in delirious patients early mobilization is difficult as pain is less likely to be well controlled. This may be another factor as to why delirious patients mobilized later.

Patients who developed postoperative delirium were 2.3 times more likely to develop another complication. Viewing

this in light of the associated reduction in delirium with early mobilization, it is clear that delirium is a major factor in both postoperative complications and early mobilization. Whereby early mobilization is associated with lower rates of delirium or vice versa with delirium being associated with delayed mobilization, correlating with reduced rates of other complications.

This relationship between delirium, opioids, and early mobilization is complex and should be an area of further research.

This study's large sample size and minimal exclusion criteria allow the results to be extrapolated to most patients who have had surgical repair of their hip fracture. The primary limitation in this study is the variation in the patient's premorbid health. Although subgroup analysis alleviated this issue, it reduced the power of the study. Another limitation to the study is the rewarding of all complications as equals. As not all complications have the same strength of association with mobilization.

These results are inconsistent with the other limited published data in this field. Although this study does not show early mobilization to be superior to delayed mobilization, it also does not show it be inferior. Rather it illustrates that early mobilization is just as safe as delayed mobilization. Indicating that early mobilization is a safe technique in helping to reduce postoperative length of stay and in turn financial costs.

Conclusion

This research supports the current practice of early mobilization post–hip fracture surgery. Although showing that premorbid health and postoperative delirium are better indicators of postoperative complications than time to mobilization.

Declaration of Conflicting Interests

Funding

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