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FACTORS IMPACTING EARLY MOBILIZATION FOLLOWING HIP FRACTURE: AN OBSERVATIONAL STUDY.

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FACTORS IMPACTING EARLY MOBILIZATION FOLLOWING HIP FRACTURE: AN OBSERVATIONAL STUDY.

Abstract

Background and purpose:

Hip fracture guidelines emphasise mobilization within 48 hours of surgery. The aims of this audit were to determine the proportion of patients with hip fracture who mobilize within 48 hours, identify factors associated with delayed mobilization and identify barriers to mobilization.

Methods:

Single-site prospective audit of 100 consecutive patients (age 82 ± 9 years) admitted for surgical management of hip fracture. Data collected included time to mobilization, factors which may impact mobilization (age, weight bearing status, additional injuries, premorbid mobility status, time to surgery, dementia, delirium, postoperative complications) and barriers to mobilization as identified by the physical therapist.

Results and discussion:

Mobilization within 48 hours of surgery was achieved by 43% of patients. Multivariate logistic regression demonstrated odds of mobilizing early increased with higher New Mobility Scores, representing better premorbid mobility (OR = 1.30, 95% CI 1.06 – 1.60); odds reduced if delirium was present on day 1 or 2 (OR = 0.25; 95% CI 0.08 - 0.79). New Mobility Scores ≥ 5, which indicates independent pre-morbid mobility inside and outside the house, best predicted early mobilization in patients who did not develop delirium. No cut off score was identified for those with delirium. Identified barriers to mobilization included patient confusion, manual handling risk, patient declined and hypotension.

Conclusions:

Less than half of this cohort achieved the guideline of mobilization within 48 hours of surgery. Patients who develop delirium within the first two days of surgery or who had premorbid mobility limitation were less likely to mobilize. Identification of patients likely to have delayed mobilization will assist physical therapists with delivering appropriate management to patients with hip fracture during their acute hospital stay.

Keywords: hip fractures, early ambulation, orthopaedic surgery, medical audit.

Introduction

Hip fracture is a common, costly and potentially devastating event and is a major concern for health systems around the world. An estimated 296 000 people sustained hip fractures in the United States (US) in 2005 [1] with numbers anticipated to increase. In Australia, over 18 000 people presented to a hospital in 2015-2016 with a hip fracture.[2] Following a hip fracture, only 40-60% of people regain premorbid mobility, [3] 10 – 20 % of people in Western nations are newly institutionalised [3] and an estimated 24% of people die within 12 months. [4] Hip fracture is costly: estimated aggregate hospital costs were 4.5 billion (US dollars) in the US in 2008. [5] Direct and indirect costs from hip fracture are also predicted to rise to 1.27 billion (Australian dollars) in Australia by 2022. [6] Thus, developing and implementing evidence-based care and management for people with hip fractures has potential to improve outcomes and reduce costs for health care systems globally.

International, evidenced-based clinical practice guidelines provide varying recommendations for the early post-operative physical therapy management of people with hip fracture. Evidence-based clinical practice guidelines from the United Kingdom [7] and Australia [8] (where this study was conducted) currently recommend mobilization should start the day after surgery. Physical therapists have a key role in helping patients achieve this milestone. This is a level C recommendation, indicating evidence 'provides some support… but care should be taken in its application'. This recommendation is based on a single study that found patients who mobilize within the first 48 hours post-surgery for hip fracture have better functional outcomes than patients who mobilize after this time period.[9] We do not know whether these recommendations are achieved in practice. Evidence-based clinical practice guidelines from the US recommend supervised physical therapy be provided to patients post hip fracture across the continuum of care,[10] but do not provide any additional recommendations about when mobilization should commence. People presenting with hip

fracture may have a range of health problems that impact on early mobilization, including cognitive impairment and pre-existing mobility impairment. The purpose of this prospective audit was to explore:

(1) the proportion of patients post-surgical fixation of hip fracture who mobilize away from the bedside in the first 48 hours post-surgery;

(2) factors associated with mobilization within 48 hours post-surgery;

(3) barriers to mobilization post-surgery, as identified by the treating physical therapist.

Methods

This prospective observational study was conducted in a single Australian tertiary health service. The study was approved by the ethics committee before commencement. A waiver of individual consent was approved as all data were collected as part of routine clinical practice. Data collection commenced on 05/05/2016 and was completed on 08/09/2016.

Participants: To be eligible for inclusion, participants had to be admitted to an orthopaedic unit on an orthopaedic ward and have a hip fracture which was surgically managed. All participants were over 18 years of age. Patients who had a femoral fracture secondary to a bony lesion (e.g. metastatic fracture or prophylactic fixations) or high velocity incident (e.g. sporting or motor vehicle accidents) were not included in the audit. All consecutive admissions who met these criteria were included in the audit (n = 100).

Data collection: Data were collected prospectively by the treating physical therapist using a specifically designed data audit tool (See Audit Tool, Supplemental Digital Content 1). The tool was designed to ensure data were collected efficiently by physical therapists while providing routine clinical care. This included:

(1) Date and time of first mobilization: defined as a minimum of step transfer from bed to chair. Mobilization was monitored for a maximum of seven days postoperatively or until the person was discharged from the acute ward.

(2) Factors which may have impacted on mobilization within 48 hours, including:

- age;
- post-operative weight bearing status (weight bearing restrictions/ weight bearing as tolerated);
- presence of additional injuries (present/ absent);
- time from presentation to emergency to surgery (hours);
- American Society of Anesthesiologists (ASA) score;
- past history of dementia as documented in the medical history (present/ absent);
- premorbid mobility as assessed using the New Mobility Score (NMS). This rates walking ability indoors, outdoors and while shopping and provides a score ranging from 0 – 9, with lower scores indicating impaired mobility;[11]
- presence of post-operative delirium in the first 48 hours was assessed using the Short Confusion Assessment Measure (SHORT CAM);[12]
- major post-operative complications in the first 48 hours, defined as presence of Medical Emergency Team/ Code Blue calls, admission to critical care or return to theatre.

(3) Barriers to mobilization within 48 hours post-operatively. These were recorded on a daily basis by the treating physical therapist for all patients who did not mobilize. Predefined barriers to mobilizing, which were identified in conjunction with clinical staff, included low blood pressure, low haemoglobin, uncontrolled pain, cardiac arrhythmias, nausea and vomiting, respiratory distress, awaiting postoperative X-ray,

confusion, drowsiness, manual handling risk (defined as risk of staff or patient injury while performing the task), patient refused/unable to cooperate or time constraints. Any additional barriers to mobilization were also recorded and described.

Sample size: It was estimated that of the nine variables included in the study, up to four would be included in the logistic regression model. Based on an estimated 40% of participants not mobilizing within 48 hours,[13] 100 participants were required to allow up to four variables to be included in the logistic regression model.[14] ,.

Statistical analysis: The proportion of participants mobilizing within 48 hours and frequency of barriers to mobilization were calculated. Descriptive data were presented as medians with interquartile ranges or frequency and percentages. Factors associated with early mobilization were explored using univariate analysis (Wilcoxon Rank Sum for continuous data and Fisher's exact test for categorical data) and logistic regression. The nature of the relationship between continuous variables and mobility was explored visually. Variables which had a small number of outcomes or did not show association in univariate analysis or visual analysis were not included in the multivariate model, as indicated in Table 1. Age, dementia, delirium and pre-morbid mobility status were included in the multivariate model. New Mobility Score was entered as a linear term while age was entered as a piece-wise transformation with a break at 70 years.

Non-parametric receiver operating characteristics (ROC) analysis was performed to evaluate the ability to use NMS as a predictor of mobilizing within 48 hours. The value of mobility score with the highest Youden index was proposed as a cut-off. Sensitivity, specificity, positive and negative predictive values were calculated. Based on the results of multivariate analysis, this was restricted to patients older than 70 years and was done

separately for those with delirium and those without. All analyses were conducted using STATA 15.1.[1]

Results

Data were available for seven days for 58% of participants. The remaining participants (42%) were discharged before seven days. Characteristics of participants, including results of the univariate analysis are presented in Table 1, along with additional descriptive data. Forty-three participants (43%) mobilized within 48 hours of surgery, 24 mobilized during the first seven days, while 33 did not mobilize during the period of data collection. Of those patients who did not mobilize, 15 out of the 33 (45.5 %) were discharged and 2 died (6.0%) before seven days. ASA data could not be obtained from a number of records; thus this variable was excluded from analysis. Patients who were able to mobilize within 48 hours had a higher mobility score prior to admission and a low proportion of them had dementia or post-operative delirium (Table 1).

Insert Table 1 here

After adjusting for NMS, dementia, post-operative delirium and age, dementia no longer showed an association with mobilization within 48 hours (Table 2). An increase in NMS of 1 was associated with 30% increased odds of being mobile within 48 hours, while delirium on day 1 or day 2 reduced the odds of mobilizing within 48 hours by 75%. There was no association between age and mobilizing within 48 hours for those older than 70 years. For patients under the age of 70 years there were increased odds of mobilizing within 48

[1] StataCorp. 2017. *Stata Statistical Software: Release 15*. College Station, TX: StataCorp LLC

hours with increased age, however, due to a small number of patients in this group (n=10) the association observed might be biased.

Insert Table 2 here

Further exploration of the NMS was undertaken to determine appropriate cut scores for prediction of mobilization within 48 hours. Patients under 70 years of age were excluded from this analysis as their relationship with mobilization within 48 hours was different to those over 70 and they were a small sample. Cut scores for NMS were explored separately for those with and without delirium. For patients aged over 70 with delirium (n = 31) NMS was not a good predictor of mobilization (Area Under the Curve [AUC] 0.56), thus no cut score was identified. For those without delirium (n = 55), NMS was a better predictor of mobilization (AUC=0.72) and a cut-off ≥ 5 was identified to have the largest Youden index (0.57), with an AUC of 0.79. Sensitivity was calculated to be 77% (95% Confidence Interval [CI] 59, 89) and specificity 81% (95% CI 58, 95), while positive predictive value was 87% (95% CI 69, 96) and negative predictive value was 68% (95% CI 47, 85).

Barriers to mobilization in the first 48 hours postoperatively as perceived by the treating physical therapist are presented in Table 3.

Insert Table 3 here

Discussion

While current clinical guidelines recommend patients with hip fracture mobilize away from the bedside within 48 hours of surgery,[8] this was achieved less than 50% of the time in this cohort. Delirium in the first two days reduced the odds of mobilising in 48 hours by 75%

178 inpatients over 70 years of age. Interestingly, premorbid mobility status did not appear to
179 impact the likelihood of mobilization for this group, although the small sample size (n = 31)
180 may have influenced this finding. For patients over the age of 70 who did not develop
181 delirium, higher scores on the NMS, which represent better premorbid mobility, increased the
182 odds of mobilizing in 48 hours. A New Mobility Score cut-off score ≥5 was identified as the
183 best predictor of mobilization; this score is equivalent to a person who can mobilize with an
184 aid in and out of the house but requires assistance from another person for shopping. This
185 cut-off score provided high specificity, sensitivity and positive predictive values (all greater
186 than 77%). However, the negative predictive value was lower; thus 32% of patients who did
187 not have delirium and had an NMS score < 5 still mobilized within 48 hours. Early
188 mobilisation of patients with impaired mobility may be influenced by other factors which
189 impact on manual handling, such as staff availability and patient weight. While patients with
190 dementia were less likely to mobilize within 48 hours, this was not independent of delirium
191 and premorbid mobility. Findings from the multivariate analysis partly align with the major
192 barriers to mobilization identified by physical therapists, which were patient confusion,
193 patient declined to mobilize and manual handling risk. Medical factors such as hypotension
194 and pain were identified as barriers on day 1, but less so on day 2; while time constraints or
195 low priority were an issue on day 2.

196 Other studies have also shown it can be difficult to achieve early mobilization within
197 48 hours of surgery. Oldmeadow et al [9] found that even when the goal was to mobilize
198 participants within 48 hours of surgery, 10 out of the 29 participants in the early ambulation
199 group did not walk within 48 hours. Kimmel et al [15] found it took a median 1.93 (n = 46
200 usual care) to 1.95 days (n = 46 intensive physical therapy) for participants to walk a distance
201 of 3 m for the first time post-operatively. This indicates that 50% of participants were unable
202 to walk 3 m at this time point. Siu et al [16] found that 50.3% of patients were able to mobilize

beyond a chair by day 2, and Buecking et al [13], in an observational study of 392 patients, found that 43% were unable to stand without help (assistance to stand up allowed) 2 days post operatively.

Other studies have also explored factors associated with delayed mobilization. Buecking et al [13] found that higher Mini Mental State Examination on admission was associated with the increased probability of standing by day 2, while ASA score, pre-fracture Barthel Index, Charlson Co-morbidity Index and Geriatric Depression Scale were associated with walking ability 4 days postoperatively. A study of 167 patients found that age $\geq$ 80 years, NMS scores between 2-6, not completing physical therapy on day 1 post operatively and haemoglobin < 6 on day 1 post operatively were associated with not regaining basic mobility (transfer in and out of bed, transfer from sitting to standing and walking with a gait aid) within 5 days.[17] Mobility on day 2 post operatively has also been shown to predict mobility 2 weeks post operatively.[18] A large audit of over 23,000 participants from the UK found that 60% of patients sat out of bed or stood within one day of surgery and this was associated with better mobility at 30 days, although data on time of mobilization was missing for 25% of participants.[19] These studies, combined with our results, indicate that while it may be desirable to mobilize patients early post operatively, this may be difficult to achieve in clinical practice, particularly for patients with premorbid mobility limitations or functional impairment.

While the evidence for early mobilization is still limited,[20] a recent single-site randomized controlled trial by Kimmel et al [15] found that providing additional sessions of physical therapy to patients with hip fracture while in the acute hospital resulted in shorter length of stay. There is also evidence that exercise, usually in the form of mobilization, is important in the prevention of delirium. A recent Cochrane review concluded that nonpharmacological multi-component interventions reduced the incidence of delirium, with

five of the seven studies including a mobilization component.[21] This is of interest, in light of our findings which suggest delirium in the first 48 hours post operatively is associated with reduced likelihood of mobilization. Reduced opportunities to exercise in the early postoperative period may increase the likelihood of delirium and delay resolution, which can impact functional recovery. These findings, combined with results of this audit, suggest there is a need to investigate novel and safe ways of providing therapeutic doses of exercise to patients with hip fracture. Innovative management options are needed for patients with premorbid mobility limitation or at risk of delirium as they are at risk of delayed mobilization.

Similarities between our findings and the results of other studies [9, 13, 15-18] suggest results are likely to be generalizable to other health services who manage patients with acute hip fracture, however, there are limitations of this audit. This was a single site study, so it is important to explore compliance with guidelines at other sites. All data were collected by treating physical therapists and barriers reflect perceptions of the treating physical therapists, which may introduce a source of bias. Additionally, there is potential overlap and lack of clarity around some barriers. For example, identification by the physical therapist of a 'manual handling risk' may be influenced by factors such as patient anthropometics, mobility level and ability to follow instructions. Nonetheless, consideration of barriers is an important step towards identifying novel methodologies to improve mobilization rates. We acknowledge a number of other factors may impact early mobilization, such as depression, fear of falling, anaesthetic type and post-operative analgesia. To minimise burden on clinical staff and reduce the likelihood of missing data, we focussed on variables that were either routinely collected or required minimal additional time or effort to collect. Sample size also limited the inclusion of other variables. The development of hip fracture registries combined

with electronic medical records and data collection will facilitate the inclusion of more variables and larger sample sizes in future studies.

Mobilization was classified as a minimum of a step transfer from the bed to chair, which was chosen as it required some physical input from the patient. Patients unable to perform at this level were sat out of bed using mechanical assistance such as hoists, providing there were no medical contraindications. There were also a group of patients who did not mobilize within the audit period; nearly half of this group did not have data for the full seven days as they died (n = 2) or were discharged (n = 15) before seven days. Of the group who were discharged before seven days, most of these patients (n = 11) were transferred back to a residential care facility and had low levels of mobility premorbidly.

Results suggest potential interventions need to minimize manual handling risk, be appropriate for patients with previous mobility limitations and be deliverable to patients with delirium or confusion. Mechanical devices such as hoists mitigate manual handling risks. However, if used solely to passively 'lift' a patient into a chair, they provide minimal opportunity for patients to exercise lower limb muscles. There are various weight support systems which provide assistance for people while walking or transferring, however many still require two or more staff to apply. Exploration of other methods of delivering exercise to this group should be explored. It is also essential that health services and health professionals recognise the importance of appropriate staffing resources and equipment to ensure safe mobilization for this cohort of patients.

Conclusions

Results from this study indicate that patients with premorbid mobility limitations and post-operative delirium are at risk of delayed mobilization following hip fracture. Early mobilization is resource intensive, often requiring two staff members to ensure both patient

and staff safety. Identification of those unlikely to mobilize in the first 48 hours post-surgery may assist clinical decision making and guide early post-operative rehabilitation.

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Declaration of Interest Statement:

The authors declare no conflicts of interest

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Table 1. Participant characteristics

	All participants (n = 100)	**Mobilized < 48 hours (n = 43)**	**Not Mobilized < 48 hours (n = 57)**	**p-value[a]**
Age (years)	84 (78- 88)	84 (78 – 88)	84 (78 – 88)	0.704
Male (n, %)	34 (34%)	18 (42%)	16 (28%)	0.201
New Mobility Score	5 (3-9)	7 (5-9)	4 (2 – 6)	<0.001
Previous living situation				
High Level Care (n)	23 (23%)	5 (11.6%)	18 (31.6%)	
Low level care (n)	12 (12%)	3 (7.0%)	9 (15.8%)	
Home (n)	62 (62%)	33 (76.7%)	29 (50.9%)	
Other (n)	3 (3%)	2 (4.7%)	1 (1.8%)	
Past history dementia				
Yes (n)	29 (29%)	7 (16%)	22 (39%)	0.025
Time ED Admission to Surgery (hours)[e]	29.9 (20.1 – 44)	27.8 (18.2 – 50.1)	31.8 (23.0 – 42.8)	0.442
Procedure				0.244
Dynamic Hip Screw/ Anti-rotation screw (n)	36 (36%)	15 (34.9%)	21 (36.8%)	
Hemiarthroplasty (n)	34 (34%)	13 (30.2%)	21 (36.8%)	
Intramedullary nail (n)	18 (18%)	7 (16.3%)	11 (19.3%)	
Total hip replacement (n)	4 (4%)	4 (9.3%)	0	
Other (n)	8 (8%)	4 (4%)	4 (7.0%)	
Weight bearing status[e]				

Weight bear as tolerated (n)	84 (84%)	34 (79%)	50 (88%)	0.279
Partial/ Protected WB (n)	16 (16%)	9 (21%)	7 (12%)	
Other Injuries[e]				
Yes (n)	17 (17%)	8 (19%)	9 (16%)	0.791
Delirium day 1 or 2[b]				
Yes (n)	35 (33%)	6 (15%)	29 (53%)	<0.001
Adverse Event within 48 hours surgery[e]				
Yes (n)	7 (7%)	2 (5%)	5 (9%)	0.695
Time Surgery to first mobilization (hours)[c]	38.8 (67.0 – 19.0) (n = 64)	20.8 (15.3 – 36.2) (n = 40)	69.1 (65.3 – 92.6) (n = 24)	
Acute LOS (days)	8 (6 – 10)	8 (5 – 10)	8 (6 – 10.5)	
Total LOS (days)[d]	11 (6 – 27)	14 (6 – 25)	10 (6 – 27)	
D/C destination from acute.				
Home (n)	7 (7%)	4 (9.3%)	3 (5.3%)	
Subacute Care (n)	67 (67%)	36 (83.7%)	31 (54.4%)	
Residential Care (n)	19 (19%)	2 (4.7%)	17 (29.8%)	
Died (n)	6 (6%)	1 (2.3%)	5 (8.8%)	
Other (n)	1 (1%)	0 (0%)	1 (1.8%)	

Note. All data reported as median (IQR) or frequency (%).

[a]Univariate statistics only calculated for variables considered for inclusion in the multivariate analysis.

[b]Delirium data missing for 4 participants on either day 1 or day 2.

[c]Time of mobilization data not available for 3 participants. These participants all mobilized on day 1 postoperatively, thus were classified as mobilizing within 48 hours.

[d]Total length of stay = acute LOS and subacute LOS

[e] Variable not included in multivariate model.

ED = Emergency department; LOS = length of stay. D/C = discharge

Table 2. Odds of mobilizing within 48 hours of hip surgery (multivariate logistic regression).

	OR	95% CI	p-value
Dementia	0.89	0.25 – 3.11	0.856
Delirium	0.25	0.08 - 0.79	0.019
New Mobility Score (NMS)	1.30	1.06 – 1.60	0.012
Age			
< 70 years (n = 10)	1.72	1.07 - 2.76	0.023
≥ 70 years (n = 86)	0.97	0.90 – 1.05	0.513

Note n = 96. Delirium data were missing from four participants; hence they were not included in the analysis.

Table 3. Barriers to mobilization as identified by the treating physical therapist on days 1 and 2 postoperatively.

	Day 1	**Day 2**
Confusion (n)	15	8
Manual handling risk (n)	12	12
Patient declined (n)	11	10
Hypotension (n)	14	4
Pain (n)	7	1
Drowsy (n)	3	2
Other (n)	3	3
Low Hb (n)	1	6
Cardiac changes (n)	1	2
Not priority/ time constraints (n)	0	6
Respiratory distress (n)	0	2
Nausea and vomiting (n)	0	0
Not recorded (n)	3	5

Note: Some participants had more than one barrier recorded.

Supplemental Digital Content

Supplemental Digital Content 1_Audit Tool.docx