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ORIGINAL ARTICLE

NO REST FOR THE WOUNDED: EARLY AMBULATION AFTER HIP SURGERY ACCELERATES RECOVERY

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Background: Level 3 evidence-based guidelines recommend first walk after hip fracture surgery within 48 h. Early mobilization is resource and effort intensive and needs rigorous investigation to justify implementation. This study uses a prospective randomized method to investigate the effect of early ambulation (EA) after hip fracture surgery on patient and hospital outcomes.
Methods: Sixty patients (41 women and 19 men; mean age 79.4 years) admitted between March 2004 through December 2004 to The Alfred Hospital, Melbourne, for surgical management of a hip fracture were studied. Randomization was either EA (first walk postoperative day 1 or 2) or delayed ambulation (DA) (first walk postoperative day 3 or 4). Functional levels on day 7 post-surgery, acute hospital length of stay and destination at discharge were compared.
Results: At 1 week post-surgery, patients in the EA group walked further than those in the DA group ($P = 0.03$) and required less assistance to transfer ($P = 0.009$) and negotiate a step ($P = 0.23$). Patients in the EA group were more likely to be discharged directly home from the acute care than those in the DA group (26.3 compared with 2.4%) and less likely to need high-level care (36.8 compared with 56%). A failed early ambulation subgroup had significantly more postoperative cardiovascular instability and worse results for all outcome measures.
Conclusion: EA after hip fracture surgery accelerates functional recovery and is associated with more discharges directly home and less to high-level care.

Key words: early ambulation, hip fracture, recovery outcome.
Abbreviations: DA, delayed ambulation; EA, early ambulation; FEA, failed early ambulation; ILOA, Iowa level of assistance; SOOB, sit out of bed; TEA, true early ambulation.

INTRODUCTION

Hip fractures are a significant problem for health-care providers because of the increasing incidence of fractures in an ageing population.[1–3] Hip fracture is the most frequent fracture for persons over 80 years of age and the second most frequent fracture for those over 65 years.[2] It is projected that by 2051, 23% of the Australian population will be older than 65 years and the number of hip fractures will rise fourfold (17 000 in 2004 to 60 000 in 2051).[3]

Evidence-based clinical practice guidelines regarding management of hip fracture were published in the Medical Journal of Australia in 1999[4] and updated in 2003.[5] Seventeen aspects of treatment were systematically reviewed, including mobilization after surgery. Early assisted ambulation within 48 h post-surgery was recommended. However, the recommendation was based on observational (level 3) evidence only.

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Early mobilization post-surgery is resource intensive. Patients who fracture their hip may be physically and medically compromised before their injury[6] and at risk of significant functional decline afterwards.[7] Despite routine ambulation protocols for patients with fractured hip encouraging ambulation as soon as possible after surgery, in practice the timing is commonly affected by the availability of a physiotherapist (if weekday or weekend day) and the patient's condition (medical stability). A previous study at The Alfred reported that the time to first ambulate for patients with hip fracture varied considerably.[8] For those managed by a clinical pathway that recommended early mobilization, their first walk occurred day 3 (average 89 h) post-surgery compared with day 4 (average 116 h) post-surgery for those not on pathway management.

Early mobilization is challenging and uncomfortable for the patient and requires the assistance of one or sometimes two physiotherapists available 7 days per week. Benefits must be rigorously evaluated to justify recommending ambulation soon after surgery. We undertook a prospective randomized trial of the effect of two different 'time to first ambulation' intervals after hip fracture surgery on patient and hospital outcomes.

METHODS

Consecutive patients admitted through the emergency department to The Alfred hospital for surgical fixation of an acute neck of

femur fracture (by a sliding screw, gamma nail or a hemiarthroplasty) were considered for inclusion in the study. The Alfred hospital is a university board major public teaching hospital with a large trauma service. Patients were excluded if the fracture was pathological, if postoperative orders were for non-weight bearing on the operated hip, the patient was admitted from a nursing home or the patient was non-ambulant premorbidly. The Research and Ethics Unit of The Alfred approved the study and written informed consent was obtained from the patient or their carer.

Between March 2004 and December 2004, 60 eligible patients agreed to participate in the study. Patients were randomly allocated, using a computer-generated program, into one of two time to first ambulation intervals: early (within 48 h/postoperative day 1 or 2) or delayed (longer than 48 h/postoperative day 3 or 4).

Management

All patients received routine postoperative medical and nursing clinical care, as currently practiced at The Alfred. All patients were transferred to sit out of bed (SOOB) as early as possible after surgery.

Ambulation

The physiotherapy ambulation re-education program was implemented once per day over 7 days. This program was the same for all and included walking re-education, bed exercises and chest physiotherapy as indicated. Only the time to first walk differed between the groups. The two physiotherapists who provided the treatments received instruction regarding the ambulation protocol to ensure standardization.

Patients randomized to the early ambulation (EA) group walked for the first time after their surgery with a physiotherapist(s) during standard work hours and as soon as possible on postoperative day 1 or 2. Those randomized to the delayed ambulation (DA) group did not commence walking until postoperative day 3 or 4.

Data collection

On admission, the treating physiotherapist recorded the following: sex, age, preoperative mobility, social supports, mental ability and medical comorbidity. Preoperative mobility was graded as 'mobile in the community' or 'housebound'. Housebound was defined as being unable to independently leave the home property because of disability. The social support measures related to the availability or otherwise of an onsite carer at home and the use of any community supports before admission (home help, meals on wheels and district nursing). The admitting doctor recorded any pre-existing medical comorbidity (cardiac, respiratory, neurological and diabetes) and implemented the 10 question modified Hodkinson mental ability test.[9] Scores less than 7 out of 10 on the mental ability test were considered evidence of impaired mental capacity. Medical comorbidity was recorded as the number of documented pre-existing medical conditions and ranked as either less than three conditions or equal to/more than three conditions.

On discharge, the treating physiotherapist also recorded type of surgical fixation (sliding screw, gamma nail or a hemiarthroplasty), wait time to surgery, time to first SOOB and time to first walk.

Outcome measures

The primary outcome measure was the patient's functional level, represented by the distance they walked and the level of assistance required to transfer from supine to sit, sit to stand and to negotiate one step, on day 7 post-surgery. All postoperative assessments were conducted on day 7 post-surgery, as this meant most had not yet been discharged and it offered patients' time to improve postoperatively. Seven of the patients had shorter stays and their functional level was assessed at the rehabilitation facility.

Functional level was measured using a modified Iowa Level of Assistance Scale (ILOA)[10] as this has a high intra-tester reliability ($ICC_{(1,1)} = 0.85$).[11] A blinded assessor carried out the testing. The ILOA scale was developed for patients with hip and knee arthroplasty and chosen for this study as it was designed to measure the same functional objectives: independence in transfer from supine to sitting and from sitting to standing, ambulation (walking distance) and the negotiation of one step. The tasks were graded according to the amount of assistance required (from 0, independent to 1, standby supervision; 2, minimal assistance; 3, moderate assistance; 4, maximal assistance; 5, failed to achieve and 6, not tested). The walking distance was measured as 0, >40 m; 1, 26–40 m; 2, 10–25 m; 3, 5–9 m; 4, 3–4 m; 5, 2 m and 6, <2 m. The level of assistance required to negotiate one step was also recorded.

Secondary outcome measures included discharge destination and length of stay in the acute care (days from admission to discharge from The Alfred). The selection of the discharge destination was based on a number of factors and made by all members of the multiprofessional team. The goal was discharge directly home if the patient was medically stable with independent functioning if living alone or able to manage with supervision if living with others. For those unable to be discharged directly home, a medical assessor decided the appropriate level of supportive/rehabilitative care required on discharge from the acute care.

Data analysis

Statistical analysis was carried out using SAS version 8.2. (SAS Institute, Cary, NC, USA). Continuous variables were compared using student's t-test and validated and reported using Wilcoxon rank sum test. Categorical variables were compared using χ^2-test for equal proportion. A two-sided P value of 0.05 was considered to be statistically significant.

Sample size

A difference between groups equivalent to 1 standard deviation was perceived to be of clinical importance. With 30 subjects per group, this study had a 97% power to detect a difference equal to 1 standard deviation with a two-sided P value of 0.05. A minimum of 16 subjects per subgroup was required for this study to have an 80% power to detect a difference equal to 1 standard deviation with a two-sided P value of 0.05.

RESULTS

Over 10 months, 60 consecutive eligible patients with hip fracture were recruited to the study. Twenty-nine patients were randomized into the EA group and 31 to the DA group. The mean age of the total group was 79.4 years (range, 53–95 years) and 68.3%

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were women. Premorbidly, many of the patients were housebound (31.7%) and some (14.7%) already needed a walking frame to mobilize. Nearly half of the patients (47%) had more than three pre-existing medical comorbidities. Twice as many fractures were stabilized with a sliding screw or a gamma nail as with a hemiarthroplasty.

The two groups were comparable on baseline demographics before surgery, the interventions they received including surgical fixation, the waiting time for surgery and the time to first SOBB (Table 1).

The average time to the first walk, the independent variable, was significantly different between the groups, as planned (51.9 *vs* 80.3 h; $P = 0.003$).

However, the results show that 10 patients of the EA group failed to achieve their first walk within the prescribed time frame (< 48 h; postoperative day 1 or 2). These patients formed a subset of the EA group, which we termed the failed early ambulation (FEA) group. The remaining 19 patients constituted the true early ambulation (TEA) group as all met the EA goal.

Function day 7 post-surgery

The patients in the EA group had significantly better functional recovery by 1 week post-surgery than those in the DA group ($P = 0.03$; Table 2). The EA group walked, on average, twice as far as the DA group (66.0 *vs* 29.7 m; $P = 0.03$) and required lower levels of assistance to transfer and ambulate ($P = 0.009$). There was no statistically significant difference in the levels of assistance required to negotiate one step ($P = 0.23$).

Table 1. Demographics and intervention for the two groups: Early ambulation (EA) and delayed ambulation (DA)

	Group 1 EA (n = 29)	Group 2 DA (n = 31)	P value
Demographics			
Age (years), mean (SD)	78.8 (2.14)	80.0 (2.08)	0.687
Female (n)	21	20	0.519
Premorbid mobility			
Housebound (n)	9	10	0.992
Gait aid			
Frame (n)	6	7	
Unaided (n)	20	21	0.886
Supports			
Carer/spouse (n)	16	17	0.980
>2 community services (n)	8	8	0.879
Mental ability			
Score >7/10	23	18	0.079
Medical comorbidity			
≥3 conditions	12	15	0.593
Interventions			
Surgical type hemiarthroplasty (n)	10	10	0.531
Time to surgery, mean hours (range)	58.67 (8.5–181)	54.74 (6–264)	0.770
Time to first SOOB, mean hours (range)	35.66 (13–71)	41.39 (13–120)	0.278
Time to first walk, mean days post-surgery (range)	2.38 (1–6)	3.74 (3–11)	0.001

SOOB, sit out of bed.

The differences are more marked if the FEA subset is removed. Patients in the TEA group walked 82.6 m compared with patients in the DA group who walked 29.7 m ($P = 0.008$). The TEA group also required lower levels of assistance to transfer than the DA group ($P = 0.007$) and to negotiate one step ($P = 0.12$; Table 2).

Discharge destination

More patients (17.2%) in the EA group were discharged directly home from the acute care hospital compared with those in the DA group (3.2%) ($P = 0.19$). Almost half of each group was discharged to slow stream rehabilitation facilities (51.6% of the DA group and 45.1% of the EA group; $P = 0.19$). Only 36.8% of the TEA subgroup required slow stream rehabilitation care at discharge from the acute care, whereas 70% of the FEA subgroup did so (Table 2).

Length of stay

The data from one patient in the EA group whose length of stay at The Alfred (136 days) was outside 2 standard deviations was removed from the analysis. Length of stay comparisons between groups then showed a mean overall 5.2-day longer stay for the EA than the DA group (16.6 days (range, 4–136 days) *vs* 11.4 days (range, 5–24 days); $P = 0.24$). The data of the FEA subgroup were then removed from the analysis as they had a mean stay of 17.9 days, twice as long as the TEA group (mean 9.28 days; $P = 0.003$). This showed a 2.1-day shorter length of stay for the TEA compared with the 11.4-day stay ($P = 0.59$) of the DA group.

FEA subgroup characteristics

The two subgroups of EA group were compared to identify possible differences. The TEA tended to be older than the FEA (83.8 *vs* 76.11 years; $P = 0.08$) and no other premorbid or surgical variables were significantly different (Table 3). The differences between the two subgroups were apparent post-surgery with a longer time to SOOB (43.1 *vs* 31.7 h; $P = 0.06$) and a 1 day longer wait for surgery for the FEA subgroup (FEA = 75.2 h *vs* TEA = 49.9 h *vs* DA = 54.7 h; $P = 0.19$).

Levels of independence in transfer tasks were lower in the FEA subgroup ($P = 0.47$) and overall the FEA group walked less distance than the TEA on day-7 postoperation (mean 34.7 *vs* 82.5 m; $P = 0.15$). Nine patients in the FEA subgroup were discharged to rehabilitation facilities, seven (86%) being slow stream specifically. In contrast, few of the TEA group (26%) needed this level of care ($P = 0.43$).

One patient in the FEA group died during their stay in The Alfred. Seven of the remaining nine patients in the FEA subgroup required testing for troponin levels and six were reported to be positive (Table 2). Testing for troponin levels is a routine procedure at The Alfred in any patient displaying evidence of a significant cardiac event such as atrial fibrillation or complaining of chest pain. In contrast, only 8 of the 19 patients in the TEA group required testing and of these, only 2 (10.2%) were reported positive.

DISCUSSION

The results of this study strengthen previous recommendations for EA after hip fracture surgery. Furthermore, the findings indicate

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Table 2. Day 7 postoperative outcomes per group: true early ambulation (TEA) versus failed early ambulation (FEA) versus delayed ambulation (DA)

	TEA (*n* = 19)	FEA (*n* = 10)	DA (*n* = 31)	*P* value
Function				
Mean walking metres (range)	82.55 (0.5–400)	34.70 (5–103)	29.71 (0–150)	0.008*† 0.03*‡ 0.15§
Transfers, *n* (%)				
Independent	11 (57.9)	5 (50)	4 (12.9)	0.007*†
Assistance	5 (26.3)	5 (50)	21 (67.7)	0.009*‡ 0.000*§
Step, *n* (%)				
Independent	10 (52.6)	0 (0)	23 (74.2)	0.12†
Failed/unable	4 (15.7)	9 (90)	1 (.03)	0.32‡ 0.04*§
Discharge destination				
Home *n* (%)	5 (26.3)	0 (0)	1 (3.2)	
Fast stream rehabilitation *n* (%)	6 (31.6)	2 (20)	14 (45.2)	0.38†
Slow stream rehabilitation *n* (%)	7 (36.8)	7 (70)	16 (51.6)	0.19‡
Nursing home *n* (%)	1 (5.3)	0 (0)	0 (0)	0.44§
Death *n* (%)	0 (0)	1 (10)	0 (0)	
LOS (days acute care)				
Mean (range)	¶9.27 (4–33)	17.90 (5–33)	11.39 (5–24)	0.59‡ 0.003*§
Troponin				
Tested *n* (%)	8 (42)	7 (70)	18 (58)	0.138‡
Positive *n* (%)	2 (25)	6 (85.7)	6 (33.3)	0.01*§

*Significant. †TEA versus DA. ‡EA versus DA. §TEA versus FEA. ¶*n* = 18, outlier removed.

that keeping patients in bed longer than 2 days post-surgery can contribute to delayed functional recovery and delayed discharge.

EA failed when patients were medically unstable. Current clinical practice is to prescribe bedrest in the presence of cardiovascular challenge and so ambulation was not attempted for most of these patients. The consequences of the prolonged bedrest associated with the medical instability were poorer functional progress on day 7 postoperative and a perceived need for high levels of care at discharge from the acute care. We found that cardiovascular stability is a major determinant of successful EA after hip fracture surgery. These consequences have implications for the overall health-care system.

Our finding of an association between DA and high demand for further inpatient supportive care is significant in view of the projected increases in the incidence of hip fracture in the community.

Table 3. Demographics and intervention for true early ambulation (TEA) and failed early ambulation (FEA) groups

	TEA (*n* = 19)	FEA (*n* = 10)	*P* value
Demographics			
Age (years), mean (SD)	83.80 (1.78)	76.11 (2.99)	0.08
Female *n* (%)	15 (78.9)	7 (70)	0.84
Premorbid mobility			
Housebound *n* (%)	6 (31.5)	3 (30)	0.11
Gait aid			
Frame *n* (%)	4 (21)	2 (20)	0.27
Unaided *n* (%)	15 (78.9)	5 (50)	
Supports			
Carer/spouse *n* (%)	10 (52.6)	6 (60)	0.71
>2 community services *n* (%)	4 (21)	4 (40)	0.29
Mental ability			
Score >7/10	23	18	0.94
Medical comorbidity			
≥3 *n* (%)	8 (42.1)	4 (40)	0.91
Interventions			
Surgical type hemiarthroplasty *n* (%)	7 (52.6)	4 (40)	0.75
Time to surgery, mean hours (range)	49.95 (14–137)	75.25 (8.5–181)	0.19
Time to first SOOB, mean hours (range)	31.74 (19–46)	43.10 (13–71)	0.06
Time to first walk, mean days post-surgery (range)	1.63 (1–2)	3.80 (3–6)	0.001

SD, standard deviation; SOOB, sit out of bed.

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Availability of residential beds to care for those unable to return to their pre-fracture residence is, already, a major problem to health-care administrators. Slow stream rehabilitation units provide care for the frailer, more dependent, long-stay patient and will be in high demand. There is a clear priority to identify strategies to keep the elderly mobile and able to return to the community. The rapid loss of muscle strength induced by bedrest is estimated to be at a rate of 5% per day.[12] Minimizing the time for which patients are immobile after hip fracture surgery can moderate deconditioning.

Previous studies have determined that patients operated on within 24 h of hip fracture have better outcomes relating to mobility, pain, independence, readmission and mortality at 6 months.[13,14] The average wait for surgery for both the EA and DA groups in this study was more than 50 h, predominantly due to institutional limits. For the FEA subgroup, the average wait was 75 h. However, this subgroup was no different with respect to number of pre-existing medical comorbidities at baseline and generally younger than the rest of the study cohort. We are unable to say whether the delay to surgery was the cause or effect of any medical instability and the subsequent failure to ambulate early. Further research is needed into postoperative cardiovascular instability, its prevalence, predictors and prevention in order to target interventions to permit EA after surgery.

Patients in our study who were randomized to the EA group appeared to have a longer length of stay, a result that is contrary to the findings of other studies.[15,16] However, the mean 17.8 day longer stay for those in the FEA subgroup significantly contributed to this result. The 2-day shorter stay for the TEA group suggests that in the presence of medical stability, EA can accelerate discharge. A limitation of this study is that we did not follow patients beyond the acute care and cannot say whether EA, with its associated improved functional outcomes, resulted in shorter lengths of stay overall. Given that EA can be uncomfortable and challenging for patients, investigating their experiences would also have been informative.

CONCLUSIONS

Previous recommendations to ambulate patients with hip fracture within 48 h after surgery are supported by the results of this prospective randomized trial. EA in the presence of medical stability accelerates functional recovery, contributes to shorter lengths of stay and results in lower levels of dependency at discharge from the acute care. These benefits justify the intense resources required.

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