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Loss of Ambulatory Independence Following Low-Energy Pelvic Ring Fractures

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Abstract

Introduction: Lateral compression type 1 (LC1) pelvic ring fractures make up 63% of all pelvic ring injuries. This fracture pattern is typically seen in older patients. The purpose of this study is to assess the ambulatory status of individuals sustaining LC1 fractures at long-term follow-up and what specific characteristics, if any, effect this status or functional outcomes. **Methods:** Over a 2-year period, all pelvic ring injury at 2 hospitals within one academic institution was queried. One hundred sixty-one low-energy LC1 pelvic fractures were identified. **Results:** Fifty patients were available for long-term outcomes (mean: 36 months). Long-term functional outcomes (mean follow-up: 36 months) as measured by SMFA subgroup scores were demonstrated to be 3 times higher in patients currently using assistive devices for walking ($P = .012$). Increased age ($P = .050$) was associated with the continued use of assistive walking devices. Of the patients who did not use an ambulatory device prior to LC1 injury, 5 (11.6%) sustained a fall or medical complication within 30 days of the index pelvic fracture; this was associated with the current use of an assistive ambulatory device ($P = .010$). Forty-three (86%) patients didn't use an assistive ambulatory device prior to sustaining the LC1 fracture. Seven (14%) patients utilized assistive devices both before and after the LC1 injury. Thirteen (26%) patients, who did not utilize assistive ambulatory devices prior to their injury, necessitated them at long-term follow-up. **Discussion:** Surgeons should be aware of these associations, as they can implement early interventions aimed at patients at risk, for assistive device use, following LC1 pelvic fractures. **Conclusion:** More than a quarter of the patients sustaining an LC1 pelvic fracture continue to use an aid for ambulation at long-term follow-up. Older age, complications, and falls within 30 days of this injury are associated with the utilization of an assistive ambulatory device.

Keywords

LC1, lateral compression fracture, pelvic fracture, geriatric trauma, fragility fractures, geriatric orthopedic, osteoporosis, trauma surgery

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Introduction

Lateral compression type 1 (LC1) fractures are the most common pelvic ring fracture type in the Young-Burgess fracture classification.[1] They are often sustained through a low-energy mechanism, such as a fall, and recommended management is nonoperative treatment with protected weight bearing.[1] The majority of these fractures occur in a geriatric population, typically in the setting of poor bone quality, and are considered a "fragility fracture."[2] The elderly population in the United States is rapidly increasing, and by 2030, 20% of Americans are projected to be 65 years of age or older.[3] Therefore, the prevalence of osteoporosis and fragility fractures is expected to increase as well.[4]

Pelvic fractures in the elderly are associated with significant morbidity.[5] Moreover, the mortality rates of pelvic fractures in a geriatric population have been demonstrated to be comparable to that of hip fractures.[6] Osteoporotic fractures in the elderly may beget disability and suboptimal function.[7] Furthermore, many elderly patients have diminished physiological and emotional reserves, which contributes to suboptimal outcomes.[8] Multiple studies have demonstrated that the Score for Trauma Triage in the Geriatrics and Middle Aged can successfully predict risk of inpatient mortality and risk stratify patients based on hospital quality measure outcomes and inpatient hospitalization costs.[9-11] Elderly patients with multiple

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comorbidities who were involved in debilitating trauma not only had higher mortality rates but were demonstrated to have longer admissions with higher complication rates and a greater need for intensive care unit treatment.[9] These patients were more likely to require discharge to an acute care facility, along with having higher levels of unplanned readmissions.

The ability to walk is an important and useful measure of functional capacity.[12] A limited amount of information is available on the ambulatory status of individuals who sustain LC1 pelvic fractures. The purpose of this study is 3-fold: (1) to assess the ambulatory status of individuals sustaining LC1 fractures at long-term follow-up, (2) to determine whether patient characteristics or postinjury complications are associated with decreased mobility following LC1 fractures, and (3) to assess whether differences in functional outcomes exist, following LC1 fractures, between individuals who utilize assistive ambulatory devices at long-term follow-up and those who are able to walk without the use of assistive devices.

Methods

An electronic medical record query was performed at 2 institutions within one hospital system over a 2-year period using the *International Classification of Diseases, Ninth Revision* codes for pelvic ring injury (808.43, 808.53, 808.41, 808.51, 808.42, 808.52, 808.2, and 808.3). Institutional review board approval was received for this study. Two hundred seventy-seven pelvic fracture patients identified. Imaging was reviewed by 2 fellowship-trained orthopedic traumatologists, in which each fracture was classified using the Arbeitsgemeinschaft für Osteosynthesefragen/orthopaedic trauma association (AO/OTA) classification system. Patients were included in this study if they were older than 18 years who sustained an LC1 pelvic ring fracture (OTA type 61-B2). Patients were excluded if they had a pelvic ring injury that did not fall under the OTA type 61-B2 classification. Of the 277 patients, 161 (58%) LC1 pelvic fractures were identified. All patients were treated nonoperatively for their LC1 pelvic fracture with a weight bearing as tolerated protocol. Of this group, 13 (8.1%) patients who transferred care and had no follow-up at our institution or did not have medical records pertaining to their initial injury available were excluded from final analysis.

A retrospective chart review was performed on 148 LC1 fracture patients. Demographics (age, gender), past medical history, Charlson Comorbidity Index, mechanism of injury, length of stay, in-hospital complications, postdischarge complications or events, postdischarge falls sustained, discharge disposition, and 30-day readmission rates were collected. Contact was attempted for all 148 patients to assess their long-term follow-up via telephone, in which a trained research assistant would assess pain scores and functional capabilities using the Short Musculoskeletal Functional Assessment (SMFA). Patients were also queried in regard to their activities of daily living, utilizing the Katz validated survey. Additionally, ambulatory status was recorded at long-term follow-up. Thirty-four (23.0%) patients could not be contacted, 33 (22.3%) declined to participate, and 31 (20.9%) were confirmed to be deceased. Fifty (33.8%) patients were available for long-term follow-up at a mean of 36 months from the date of injury.

Table 1. Demographics and Functional Outcomes for LC1 Fracture Patients With Long-Term Follow-Up.[a]

Age at injury	63.56 ± 18.8
Gender	Female: 76% (38); male: 24% (12)
BMI	24.12 ± 5.6
CCI	0.40 ± 0.8
Mechanism of injury	Fall-LV: 43.1% (22); other high-energy injury: 54.9% (28)
Admitted at the time of initial injury	62.7% (32)
Length of stay	6.32 ± 5.7
In-hospital complications	18% (9)
Follow-up interval (months)	36.12 ± 8.1
SMFA function index	26.07 ± 25.5
SMFA bother index	22.54 ± 24.2
SMFA activity index	36.75 ± 34.4
SMFA emotion index	26.21 ± 23.3
SMFA mobility index	26.44 ± 27.3
Total SMFA score	25.15 ± 24.9
VAS pain scores	2.53 ± 3.2
Pain quality	Intermittent: 32% (16); continuous: 14% (7); no pain: 54% (27)

Abbreviations: CCI, Charlson Comorbidity Index; LC1, Lateral compression type 1; SMFA, Short Musculoskeletal Functional Assessment; VAS, Visual analog scale.
[a] n = 50.

Statistics were calculated using IBM SPSS version 23 (Armonk, New York: IBM Corp). Chi-square analysis was used for categorical variables. An independent *t* test was used for comparison of means.

Results

Fifty patients were available for long-term follow-up, at an average interval of 36 months (range: 12-61 months). Thirty-eight (76%) patients were females and 12 (24%) were males. The average age of this cohort was 63 years (range: 18-94 years). There were 22 (44%) patients who sustained their fracture due to a low-energy fall (standing height). There were 24 (48%) patients who sustained their fracture due to a higher energy fall (greater than 2 steps). At the time of injury, 32 (64%) patients were admitted to the hospital, with an average length of stay of 6.32 ± 5.7 days. Nine (18%) patients experienced in-hospital complications.

The mean SMFA score was 25.15 ± 24.9 at latest follow-up (mean = 36 months). The average visual analog scale (VAS) pain score was 2.53 ± 3.2, with 27 (54%) patients reporting a pain score of 0. For those who experienced pain, 16 (32%) patients experienced intermittent pain and 7 (14%) patients experienced continuous pain. The aforementioned factors are reported in Table 1.

Seven (14%) patients utilized assistive devices both before and after the LC1 injury. Thirteen (26%) patients who did not utilize assistive ambulatory devices prior to their injury

Table 2. Comparison of Functional Outcomes of Patients Who Utilize an Assistive Ambulatory Device at Long-Term Follow-up, Due to Their LC1 Pelvic Fracture, as Opposed to Those Who Do Not Utilize an Assistive Ambulatory Device.[a]

SMFA Measure	New Utilization of an Assistive Ambulatory Device (n = 13)	No Utilization of an Assistive Ambulatory Device (n = 30)	*P* Value
SMFA function index	38.57 ± 28.46	12.90 ± 15.68	.008
SMFA bother index	31.57 ± 30.55	12.37 ± 15.81	.049
SMFA activity index	54.23 ± 33.75	18.89 ± 24.49	.003
SMFA emotion index	34.06 ± 27.30	15.71 ± 16.81	.010
SMFA mobility index	41.23 ± 28.88	11.75 ± 16.56	.003
Total SMFA score	36.74 ± 28.74	12.49 ± 15.56	.012

Abbreviations: LC1, Lateral compression type 1; SMFA, Short Musculoskeletal Functional Assessment.
[a]Patients who used an assistive ambulatory device prior to their injury were excluded from this analysis.

necessitated them at long-term follow-up. The remaining 60% of patients in this study did not use an assistive ambulatory device prior to or after injury. Long-term functional outcomes (mean follow-up 36 months) as measured by SMFA subgroup scores were demonstrated to be 3 times higher in patients currently using assistive devices for walking ($P = .012$). Functional status, daily activities, emotional status, and mobility were all worse in patients who necessitated assistive ambulatory devices at long-term follow-up. The SMFA scores between these cohorts are demonstrated in Table 2. No differences in VAS pain scores were demonstrated between the groups ($P = .294$).

Patients utilizing assistive devices following their LC1 pelvic fractures were older than those not using assistive devices by 14.4 years ($P = .05$). No other demographics were associated with the utilization of an assistive ambulatory device following the LC1 pelvic fracture. Of the 43 patients who did not use an ambulatory device prior to LC1 injury, 5 (11.6%) sustained a fall or medical complication within 30 days of the pelvic fracture; this was despite the current use of an assistive ambulatory device ($P = .010$).

Discussion

The management of elderly patients who sustain orthopedic trauma is an important topic in the current orthopedic literature. As the elderly population continues to rapidly grow, more of these individuals continue to partake in an active lifestyle. Hence, they are at increased risks of sustaining a fracture. Due to the prevalence of poor bone quality in the geriatric and middle aged, there are increased risks for fragility fractures due to low-energy mechanisms.[12] Lateral compression type 1 pelvic fractures are known to be an established injury in the geriatric population, and it is therefore imperative to understand the morbidity associated with these injuries and the functional outcomes of those who sustain them.[1]

This study demonstrates that over a quarter of patients sustaining LC1 pelvic fractures lost the ability to independently ambulate following this injury. Patients were more likely to need an assistive ambulatory device at long-term follow-up if they were of older age or sustained a second fall within 30 days of hospital discharge. Moreover, patients who required an assistive ambulatory device had suboptimal functional outcomes at long-term follow-up, compared to those who continued to be independent ambulators.

Following orthopedic trauma, a vital goal is providing rehabilitation to individuals with an aim of return to preinjury levels of function.[13] Of the numerous outcomes following disabling conditions, independent ambulation is considered one of the most important.[13] Utilization of walking aids has been associated with increased risks of falls, as it may affect a patients gait pattern, ambulatory speed, step length, swing time, and stance time.[14,15] Although it is often recommended that geriatric patients with fragility fractures should be discharged from the hospital on a walking aid, patients often fail to demonstrate clear understanding of the proper use of their ambulatory device.[16] Additionally, patients may not be aware of the appropriate time point to change walking aids, which subsequently hinders their return to preinjury ambulatory status.[16] Thomas et al demonstrated that the utilization of assistive ambulatory devices was deemed inappropriate in a third of hip fracture patients.[16] The authors suggest scheduling formal physical therapy follow-up appointments to determine when a walking aid is being utilized properly and when it can be safely disregarded.[16]

Increased age was a predictor of necessity for assistive ambulatory devices following LC1 pelvic fractures. Older patients have been reported to have increased rates of morbidity and mortality following pelvic fractures.[17] O'Brien et al demonstrated that elderly patients with pelvic fractures sustain higher postinjury complication rates by 2-fold, in a comparison with younger patients.[17] Chong et al reported similar results and hypothesized the worse outcomes in elderly patients to be due to increased comorbidities.[18] Furthermore, geriatric patients may lack the physiological reserves to respond appropriately to their rehabilitation.[8]

This study found that falls following hospital discharge were an additional factor associated with the long-term use of an assistive ambulatory device. Patients are at an increased risk to sustain falls after being discharged from the hospital.[19] Mahoney et al demonstrated the use of assistive ambulatory devices to be a risk factor for falls. As aforementioned, it is crucial for multidisciplinary teams to work with patients who will be utilizing assistive ambulatory devices following their

LC1 fractures. Physical therapists and orthopedic surgeons should ensure the proper assistive device is being prescribed and that appropriate utilization of this advice is established. Additionally, Mahoney et al reported patient confusion at the time of discharge to be associated with posthospitalization falls.[19] Hence, it is essential to target patients who are at increased risk for falls following an LC1 pelvic fracture, in order to employ early interventions aimed as diminishing this complication.

Patients who utilized assistive ambulatory devices at long-term follow-up, due to their LC1 pelvic fracture, were found to have significantly worse outcomes compared to independent ambulators. These patients had suboptimal functional outcomes, in all functional categories, including the bothersome nature of their injury, activities of daily living, emotional status, and mobility. The physical and emotional benefits of walking are well known, as it decreases all-cause morbidity and mortality.[12] Not being an independent community ambulator may hinder one's ability to perform adequate activities of daily living. Elderly individuals consider functional independence and the ability to carry out activities of daily living a greater priority than the prevention of disease.[20] The inability for patients to return to preinjury ambulatory status following their LC1 fractures likely hinders many of the activities important to these patients, and of course, assistive ambulatory device use thwarts patients returning to their preinjury physical activity. Similar results of this study have been demonstrated by Paterson and Warburton, in which a relationship was established between physical activity and outcomes related to functional impairment, disability, and the loss of ambulatory independence.[20] Patient-centered medicine and individualized rehabilitation plans may help a patient get back on their feet and walk without the use of assistive ambulatory devices.

Our analysis of the long-term ambulatory status of patients sustaining LC1 pelvic fractures was limited by a relatively small sample size. This study was also confined to only 2 hospitals within one single academic institution. It is our recommendations that future research should be conducted, in the form of large cohort prospective studies, in order to fully understand the factors that may contribute to the long-term use of assistive ambulatory devices following LC1 pelvic fractures.

Conclusion

More than a quarter of the patients sustaining an LC1 pelvic fracture continue to use an aid for ambulation at long-term follow-up. Older age, complications, and falls within 30 days of this injury are associated with the utilization of an assistive ambulatory device. Surgeons should be aware of these associations, as they can implement early interventions aimed at patients at risk, for assistive device use, following LC1 pelvic fractures.

Declaration of Conflicting Interests

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