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## Quality of Life and Functional Independence of Hip Fracture Patients: Data from a Single Center Follow-Up Study in Sri Lanka

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### Abstract

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#### Background

Data on the functional outcomes of hip fracture patients in Sri Lanka are limited. As this information is required for the design of long-term care plans, we assessed the physical activities (activities of daily living [ADL]) and quality of life (QoL) of hip fracture survivors in Sri Lanka.

#### Methods

A group of 180 consecutive patients with incident hip fractures admitted to a tertiary care center in Southern Sri Lanka were followed up for 12 months. The Sinhala versions of the Barthel Index, 36-Item Short-Form Survey, and Mini-Mental State Examination were used to assess ADL, QoL, and mental status, respectively.

#### Results

Of the 180 patients (149 women), 107 underwent surgery. An initial sharp decline and partial recovery of ADL and QoL were observed among patients with hip fractures. Furthermore, patients who underwent surgical treatment showed faster recovery of ADL and QoL than did patients who were

managed conservatively. Similarly, patients who did not have complications during the hospital stay showed faster recovery of ADL and QoL than did patients with one or more complications.

## Conclusions

Hip fractures profoundly affected both ADL and QoL, and recovery remained incomplete at 12 months post fracture. Patients who underwent surgery had a faster recovery than did patients who did not undergo surgery; similarly, patients without complications also had a faster recovery than did those with complications.

**Keywords:** Quality of life, Sri Lanka, Functional status, Hip fractures

## INTRODUCTION

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Hip fracture is considered the most ominous clinical outcome of osteoporosis because of the high mortality, morbidity, and healthcare costs.<sup>1,2</sup>) Patients with hip fractures have higher mortality rates during their hospital stays and for years after discharge.<sup>2</sup>) Following a hip fracture, mortality is higher during the initial 6 months than the next 6 months, and compared to that in an age-matched normal population, this increased mortality persists for several years.<sup>3,4</sup>) Johnston et al.<sup>5</sup>) observed that mortality among patients aged >85 years with hip fractures tended to return to the level in the background population after 2–5 years, whereas increased mortality persisted beyond 8 years post fracture among those <85 years. Apart from mortality related to hip fractures, deaths due to comorbidities also account for the increased mortality apparent after such fractures.<sup>6</sup>)

In addition to excess mortality, hip fractures are also associated with high healthcare costs, which vary among countries. A Canadian study in 2013 estimated a mean attributable cost in the first year after fracture of Can\$36,929 among women and Can\$39,479 among men, translating to Can\$282 million in directly attributable healthcare costs in Ontario and Can\$1.1 billion in Canada annually.<sup>7</sup>) Further, a similar study in New Zealand<sup>8</sup>) reported a combined total cost over 2 years post operation for hip fracture of NZ\$66,637,355. According to Cheung et al.,<sup>9</sup>) the direct cost of hip fractures will increase from US\$9.5 billion in 2018 to US\$15 billion in 2050 in nine member countries of the Asian Federation of Osteoporosis Societies.

Aside from the economic implications, impairment of physical function and quality of life (QoL) frequently occurs among hip fracture survivors. Nearly 40%–50% of hip fracture survivors have limitations in at least one activity of daily living (ADL) 12 months after a fracture.<sup>10,11</sup>) Studies have also shown a sharp reduction in physical function and QoL immediately after hip fracture, with partial recovery later.<sup>12-14</sup>) The high physical dependency in the post-fracture period is an added burden on caregivers and family members, leading to the institutionalization of patients who are severely affected. Lin and Lu<sup>15</sup>) observed that 56.7% of caregivers in Taiwan reported “feeling exhausted” because of the added workload of caring for family members with hip fractures.

Asia, with the expanding elderly population, will become the epicenter of hip fractures. On the basis of epidemiological data from four Asian countries—Singapore, Malaysia, Thailand, and Hong Kong—Lau et al.<sup>16)</sup> predicted that hip fractures would become a major public health challenge in this region. Cheung et al.<sup>9)</sup> predicted that the number of hip fractures would increase from 1,124,060 in 2018 to 2,563,488 in 2050 in the Asian region. Despite these alarming predictions, the preparedness of these countries to meet the challenges of hip fractures is not clearly evident. In South Asian countries, epidemiological data on patients with hip fracture related to causation and short- and long-term clinical outcomes are sparse compared to those in Western countries. This information gap is a major limitation to resource allocation and the design of health and social care pathways. More studies are needed to inform the relevant authorities to make changes in the current health and social care services to face the predicted burden of hip fractures in these countries.

This 12-month follow-up study assessed the physical dependence and QoL of patients admitted with incident hip fractures to a tertiary care center in Southern Sri Lanka. After an extensive search of the major electronic databases, we were unable to identify previous studies examining the QoL of hip fracture survivors in Sri Lanka.

## MATERIALS AND METHODS

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This prospective cohort study did not include a parallel control group. Follow-up data from a hip fracture registry maintained since September 2017 were used for this analysis. One hundred eighty patients with incident fragility hip fractures (FHF) admitted consecutively to a tertiary care center (Teaching Hospital, Karapitiya, Galle) in the southern province of Sri Lanka were followed up for 12 months. Written informed consent was obtained from all patients or their immediate family members before recruitment. This study included only those patients with new hip fractures resulting from a simple fall (from a standing height or less) and excluded patients with high-energy (non-fragility) fractures and readmissions for the same fracture. The study was approved by the Ethics Review Committee of the Faculty of Medicine, University of Ruhuna, Sri Lanka (No. 19.12.2016: 3.3).

In this study, we applied the validated Sinhala version of the 36-Item Short-Form Survey (SF 36)<sup>17)</sup> to assess the QoL at discharge and at 3, 6, and 12 months post-fracture. We assessed ADL using the Sinhala version of the Barthel Index (BI)<sup>18)</sup> at five time points: 1 week before the fracture; at the time of discharge; and at 3, 6, and 12 months after the fracture. Finally, we assessed the mental state of the patients at discharge using the validated Sinhala version of the Mini-Mental State Examination (MMSE).<sup>19)</sup> Members of the research team visited the relevant wards regularly to collect data, and patients were followed up with regular telephone calls and in-person meetings during subsequent hospital visits. Some patients were interviewed at their residences to collect data.

On the basis of the information on comorbidities gathered from patients during the interview and collected from case notes, we calculated the age-adjusted Charlson Comorbidity Index (ACCI) by weighting comorbid conditions and adding additional points for each decade over 40 years of age.<sup>20,21)</sup>

Data are presented as mean±standard deviation, median (interquartile range), or number (percentage). We applied the chi-square and independent t-test for categorical and numerical data, respectively, and used analysis of variance (ANOVA) to compare two groups. Statistical significance was set at  $p < 0.05$ .

## RESULTS

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### Sociodemographic and Clinical Characteristics of Patients with an FHF

The study cohort included 180 consecutive patients (149 women) with incident hip fractures admitted during the study period to the Teaching Hospital, Karapitiya, Galle, Sri Lanka. All fractures occurred following minor falls from a standing height or less. [Table 1](#) presents the sociodemographic and clinical characteristics of the patients with FHF according to the management of their hip fractures. Seven patients (59%) underwent surgery; the others were managed conservatively (non-surgically). Five patients died while in the hospital, whereas 28 died during the 12-month follow-up. Furthermore, 53 patients (29%) developed one or more complications during their hospital stay. These complications included pressure ulcers (14 patients, 7.8%), respiratory tract infections (10 patients, 5.6%), urosepsis (19 patients, 10.6%), and acute myocardial ischemia (4 patients, 2.2%) ([Table 2](#)).

#### Table 1.

Sociodemographic and clinical characteristics of patients with surgically and conservatively managed fragility hip fractures

Characteristic	FHF patient management (n=180)	
	Surgical (n=107)	Conservative (n=73)
Sex, female	90 (84.1)	59 (80.8)
Age (y)	73.6±8.0	82.0±8.5
History of previous fragility fracture	8 (7.5)	6 (8.2)
Family history of fragility fracture	9 (8.4)	7 (9.6)
Smoking	7 (6.5)	7 (9.6)
Alcohol consumption	9 (8.4)	10 (13.7)
Use of glucocorticoids	32 (29.9)	19 (26.0)
Comorbid conditions		
Vascular diseases	39 (36.4)	32 (43.8)
Dementia	2 (1.9)	10 (13.7)
COPD/bronchial asthma	23 (21.5)	22 (30.1)
Rheumatic diseases	3 (2.8)	3 (4.1)
Peptic ulcer disease	14 (13.1)	4 (5.5)
Liver disease	5 (4.7)	5 (6.8)
Diabetes mellitus	15 (14.0)	21 (28.8)
Renal diseases	0 (0)	4 (5.5)
Hypertension	34 (31.8)	35 (47.9)
Hyperlipidemia	10 (9.3)	3 (4.1)

Values are presented as number of patients (%) or mean±standard deviation.

COPD, chronic obstructive pulmonary disease.

**Table 2.**

Comparisons of complications between surgically and conservatively managed patients with fragility hip fractures

Complications	FHF patient management (n=180)		p-value <sup>a)</sup>
	Surgical (n=107)	Conservative (n=73)	
Pressure ulcer	3 (2.8)	11 (15.1)	0.003
Wound infection	1 (0.9)	8 (11.0)	0.002
Urinary tract infection	7 (6.5)	12 (16.4)	0.034
Acute renal failure	1 (0.9)	2 (2.7)	0.353
Cardiac complication	1 (0.9)	4 (5.5)	0.068
Pneumonia	2 (1.9)	8 (11.0)	0.009
Myocardial infarction	2 (1.9)	2 (2.7)	0.697
Cerebrovascular accident	2 (1.9)	3 (4.1)	0.369
Pulmonary embolism	0 (0)	3 (4.1)	0.034
Deep venous thrombosis	0 (0)	3 (4.1)	0.034
Gastrointestinal bleeding	3 (2.8)	0 (0)	0.149
Number of complication(s)			
0	91 (85.0)	36 (49.3)	< 0.001
1	12 (11.2)	21 (28.8)	< 0.001
2+	4 (3.7)	16 (21.9)	< 0.001

Values are presented as number of patients (%).

<sup>a)</sup>Chi-square test.

### Physical Dependence and QoL of Patients with Hip Fractures during 12 Months Post-fracture

An initial sharp decline and partial recovery in ADL were observed among patients with hip fractures ( [Table 3](#)). A similar pattern was evident in the total score and physical and psychological domains of the SF-36 ([Table 4](#)). In addition, the ADL score at 12 months was below the pre-fracture score.

**Table 3.**

Changes in the physical dependence of patients with hip fractures during 12 months post-fracture

<b>Time of assessment</b>	<b>Barthel index</b>	<b>Physically dependent subjects<sup>a)</sup></b>
Before fracture (n=180)	100 (95–100)	10 (5.6)
At discharge (n=175)	30 (20–45)	175 (100)
At 3 months (n=172)	40 (15–60)	172 (100)
At 6 months (n=159)	55 (20–80)	152 (95.6)
At 12 months (n=147)	85(30–90)	87 (59.2)

Values are presented as median (interquartile range) or number of patients (%).

<sup>a)</sup>Barthel index <90.

**Table 4.**

Changes in SF-36 total scores and physical and psychological domains

<b>Measure</b>	<b>At discharge (n=175)</b>	<b>At 3 months (n=172)</b>	<b>At 6 months (n=159)</b>	<b>At 12 months (n=147)</b>
Physical health	9.6 (6.7–11.7)	19.3 (10.2–22.7)	33.8 (13.1–45.6)	44.6 (16.5–56.7)
Psychological health	13.3 (11.7–15.0)	28.3 (15.4–31.7)	44.6 (15.4–58.8)	60.8 (14.2–73.0)
Total SF-36 score	11.0 (7.9–12.8)	22.0 (11.1–25.7)	34.0 (10.7–49.9)	40.0 (8.1–60.4)

Values are presented as median (interquartile range).

SF-36, 36-item Short-Form Health Survey questionnaire.

## Determinants of QoL at 12 Months

In the correlation analysis, age and ACCI were found to be inversely related to the two domains of QoL, whereas BI measured at five time points showed positive correlations ([Table 5](#)).

**Table 5.**

Correlations of two domains of the SF-36 at 12 months with selected variables

Variable	SF-36 at 12 months		p-value <sup>a)</sup>
	Physical health domain	Psychological health domain	
Age	-0.53	-0.48	<0.001
ACCI	-0.42	-0.38	<0.001
BI before fracture	0.33	0.35	<0.001
BI at discharge	0.61	0.59	<0.001
BI at 3 months	0.86	0.85	<0.001
BI at 6 months	0.89	0.89	<0.001
BI at 12 months	0.90	0.90	<0.001
MMSE at discharge	0.42	0.38	<0.001

SF-36, 36-item Short-Form Health Survey questionnaire; ACCI, age-adjusted Charlson Comorbidity Index; BI, Barthel Index; MMSE, Mini-Mental State Examination.

<sup>a)</sup>Pearson correlation.

Analysis of the trends of BI and SF-36 values over time showed a steady increase in all indices in the group of patients who underwent surgery. In contrast, no major improvement in QoL indices was observed, as ADL decreased slightly over time ([Table 6](#)) in patients who were managed conservatively. We observed similar trends for the groups of patients with one or more or no complications during their hospital stay ([Table 6](#)).



**Table 6.**

Trends in BI and SF-36 scores during follow-up according to the type of treatment and the presence or absence of complications

	At discharge	At 3 months	At 6 months	At 12 months	p-value <sup>a)</sup>	
					Within-group	Intergroup
Surgical	(n=106)	(n=105)	(n=103)	(n=101)		
SF-36 physical	11.3±2.9	24.7±8.8	41.6±9.9	51.7±10.8	<0.001	<0.001
SF-36 psychological	14.1±2.5	33.8±9.9	54.9±14.0	66.8±14.4	<0.001	<0.001
Conservative	(n=69)	(n=67)	(n=56)	(n=46)		
SF-36 physical	5.9±2.5	9.8±4.0	11.1±6.6	11.5±6.2	<0.001	
SF-36 psychological	10.8±3.4	12.7±3.9	12.2±5.7	12.5±7.8	<0.001	
BI						
Surgical BI	37.7±10.4	56.0±14.7	68.7±15.5	85.8±12.0	<0.001	<0.001
Conservative BI	24.1±9.7	17.0±7.5	16.3±7.6	16.6±10.0	<0.001	
No complications	(n=122)	(n=121)	(n=117)	(n=116)		
SF-36 physical	9.9±3.8	21.0±10.6	34.5±15.7	42.4±20.3	<0.001	>0.001
SF-36 psychological	13.3±2.9	28.7±12.9	44.5±22.6	54.1±26.6	<0.001	>0.001
BI	33.3±13.1	45.2±23.6	53.1±30.0	63.8±37.2	<0.001	<0.001
With complications	(n=53)	(n=51)	(n=42)	(n=31)		
SF-36 physical	7.5±3.4	13.7±7.4	20.6±16.5	26.5±19.0	<0.001	
SF-36 psychological	11.6±3.6	18.4±10.7	26.7±23.0	33.6±28.7	<0.001	
BI	26.5±11.7	24.2±16.8	23.7±22.5	25.0±31.0	<0.001	

Values are presented as mean±standard deviation.

BI, Barthel Index; SF-36, 36-item Short-Form Health Survey questionnaire.

<sup>a)</sup>Analysis of variance (ANOVA).

## DISCUSSION

This analysis revealed a sharp decline in ADL and QoL after a hip fracture and a gradual but partial recovery over the next 12 months. The ADL score of patients with FHF at 12 months did not reach the pre-fracture level, and nearly 60% still had a limitation of at least one ADL function at 12 months post fracture.

We observed that age and comorbidity negatively impacted QoL at 12 months post hip fracture, whereas ADL, both pre- and post-fracture ADL, and MMSE score at discharge showed positive influences on QoL. Patients managed surgically showed steady improvements in both ADL and QoL over the next 12 months compared with patients who were managed non-surgically. Similarly, patients without complications during hospital stay showed greater recovery of ADL and QoL than did patients with complications.

Physical dependence and poor QoL after hip fracture are common observations, and the findings of the current study are consistent with those reported previously. Analyzing a large cohort of 10,325 patients, Gjertsen et al.<sup>22)</sup> noticed a marked reduction in QoL, and 58% of patients reported walking difficulty at 12 months post fracture. Hall et al.<sup>10)</sup> also observed reduced QoL, difficulties in maintaining balance, and reduced physical activity in patients with hip fracture compared to those in age-matched controls. Furthermore, patients with hip fractures were unable to achieve pre-fracture mobility and independence. Many other studies have also reported the negative impact of hip fractures on QoL and physical function, including those by Milte et al.,<sup>23)</sup> Prieto-Alhambra et al.,<sup>12)</sup> Tarride et al.,<sup>24)</sup> Lim,<sup>25)</sup> and Amarilla-Donoso et al.<sup>13)</sup>

In this study, age and comorbidity negatively affected the QoL of patients with hip fractures, whereas cognition and function (represented by MMSE) and independence in ADL positively affected the QoL of patients with hip fractures. Furthermore, patients treated surgically and those without complications had better outcomes. Amarilla-Donoso et al.<sup>13)</sup> also reported that health-related QoL (HRQoL) scores at 1-month post-fracture was related to pre-fracture BI, depression, and surgery type. The influence of pre-fracture BI and MMSE on the QoL of hip fracture survivors has also been reported by others.<sup>26)</sup> While Gjertsen et al.<sup>22)</sup> and Milte et al.<sup>23)</sup> showed the influence of age on the outcome of patients with hip fractures, Tarride et al.<sup>24)</sup> found that, among many predictors, mobility was a strong predictor of QoL in these patients. Moreover, although they observed a partial recovery of HRQoL after 1 month, it remained below the pre-fracture level even 36 months post-fracture.

The positive association between ADL and QoL suggests the need for caregivers to focus on interventions that enhance the physical independence of patients with hip fractures. Unlike age and comorbidities, ADL is a modifiable determinant of QoL. Thus, attempts must be made to improve the QoL of these patients by improving their ADL. However, this concept needs to be tested in an interventional study before implementation.

Our observations reconfirm the debilitating nature of hip fractures. Although a gradual improvement in both ADL and QoL is observed during the first year, patients did not reach pre-fracture ADL, and their QoL remained lower. Furthermore, nearly 58% of patients were not fully physically active at 12-month post-fracture. Poor QoL and ADL make patients with hip fractures a burden for their families and caregivers.<sup>15)</sup>

Only 59% of patients in our study group had undergone surgery. The reasons for non-surgical management included advanced age, higher comorbidity, and lack of consent for the procedure. The ADL and QoL at each follow-up were greater among patients who had undergone surgery than among those who were managed conservatively. Compared with non-surgical management, surgery,

particularly when performed early, showed advantages related to mortality, ADL, and QoL in hip fracture patients.<sup>27)</sup> Yoon et al.<sup>28)</sup> reported higher cumulative mortality rates for up to 2 years and a higher prevalence of non-functional ambulatory state among hip fracture patients managed conservatively than among those who had undergone surgery. Furthermore, higher rates of complications (12.5% vs. 6.6%) and mortality (7.4% vs. 1.7%) were observed among hip fracture patients managed conservatively than among those managed surgically.<sup>29)</sup>

In the current study, all patients were followed up for 12 months post-fracture, except for 33 patients who died during the 12-month follow-up. This can be considered a strength of this study. The study, however, was limited to one area of the country; thus, studies of similar nature from other parts of the country are needed before generalization of the results. Another limitation was that we did not assess other measurements of physical function such as gait speed or chair rise in this study.

In conclusion, hip fractures led to a rapid decline in ADL and QoL immediately after the event, with a gradual but partial recovery during the first 12 months post-fracture. We observed significant differences in the ADL and QoL between surgically and conservatively treated patients and between those who did and did not have complications. On the basis of these findings, we urge relevant authorities to take steps to increase the rate of surgical treatment for patients with hip fractures. To achieve this, the barriers and limitations of surgical treatment should be assessed and the necessary steps be taken to address them. Furthermore, steps should also be taken to avoid post-fracture complications. Most complications can be avoided by adhering to proper nursing practices, venous thromboembolism prophylaxis, and early mobilization.

## Footnotes

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### **CONFLICT OF INTEREST**

The researchers claim no conflicts of interest.

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### **AUTHOR CONTRIBUTIONS**

Conceptualization, TA, SL, JL, GA; Data curation, TA; Formal analysis, TA, SL; Funding acquisition, TA, SL; Investigation, TA; Methodology, TA, SL, JL, GA; Project administration, TA, SL, JL, GA; Supervision, SL, JL, GA; Writing-original draft, TA, SL; Writing-review & editing, TA, SL.

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