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Diabetes and Health Outcomes Among Older Taiwanese with Hip Fracture

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Abstract

Objective: Hip fracture tremendously impacts functional abilities for the elderly with high morbidity and mortality; recovery is compromised by co-morbidities. Diabetes mellitus is a common co-morbidity for the aging population, but little is known about the influence of diabetes on outcomes of the Asian elderly with hip fracture.
Research Design and Methods: This study was a secondary analysis of data on 242 community-dwelling elders with hip fracture from three previous longitudinal studies. Sixty-one cases (25.2%) had diabetes. Outcomes were measured by the Chinese Barthel Index, Medical Outcomes Study Short Form-36 Taiwan version, and analyzed by the generalized estimating equation approach to examine how diabetes influenced hip-fractured elders' mortality, service utilization, mobility, daily activities, and health-related quality of life during the first 12 months after postsurgical discharge in Taiwan.
Results: Hip-fractured elderly with diabetes had a significantly higher mortality rate (22.6% vs. 10.3%, $p = 0.03$) during the first year following discharge, and significantly higher readmission rate (10.0% vs. 2.5%, $p = 0.04$) from the first to third month following discharge than those without diabetes. After controlling for covariates, elderly participants without diabetes had an overall 2.2 times (confidence interval [CI] = 1.15–4.21) greater odds of recovery in walking ability and better reported general health ($\beta = 9.33$; $p = 0.01$) and physical functioning ($\beta = 7.26$; $p = 0.02$) than those with diabetes during the first year after discharge.
Conclusions: Diabetes negatively influenced outcomes of elderly patients with hip fracture. The results may provide a reference for developing interventions for hip-fractured elders with diabetes.

Introduction

Hip fracture usually impacts on functional activities and walking ability of the elderly and contributes to high morbidity and mortality.[1] Even for hip-fractured elders undergoing surgery, the mortality rate within 1 year was 16.3%–25.3%,[2,3] and only 40%–56.1% recovered their previous physical function after 1 year.[3,4] The incidence of hip fracture increases with increasing age.[5] With the global population aging, the incidence of hip fracture is expected to reach 6.26 million by 2050.[6] In Taiwan, the population age ≥65 years was 10.6% in 2009 and is expected to reach 41.6% by 2060.[7] Because Taiwan has the highest age-standardized hip fracture rate in Asia,[8] hip fracture in the elderly has become a major concern in Taiwan.

In Taiwan, 72.4% of the elderly suffered at least one chronic disease and about 50% suffered two concurrently[9]; predictably, co-morbidity will negatively influence outcomes of the hip-fractured elderly. Among co-morbidities in Taiwan, diabetes mellitus (DM) was the fifth leading cause of death in 2010, with its prevalence increasing annually and with age.[10] Moreover, 18% of the Taiwanese elderly (age ≥ 65 years) suffer from DM and the majority have type 2 diabetes (T2DM).[11]

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Elders with diabetes have been shown to have a higher incidence of hip fracture than those without diabetes, and this incidence is related to the duration of DM, its complications, and the use of insulin.[12–21] However, few studies have explored the influence of DM on outcomes after hip fracture, with inconsistent findings.[22–28] One study found that among hip-fractured elders, those with diabetes ($n=69$) had significantly higher mortality than those without diabetes ($n=161$) (32% vs. 12.7%) 1 year after fracture, and mortality was related to their age, postsurgical complications, and elevated glycosylated hemoglobin level.[22] A secondary analysis of data classified 79,526 hip-fractured elders from 915 rehabilitation facilities in the United States into three groups: No DM (77%), non-tier diabetes (18.3%), and tier DM (4.7%).[23] The tier DM group had longer lengths of hospital stay, worse functional status, and lower odds of discharge home, and the influence of DM on recovery from hip fracture was moderated by age.[23] Another study also demonstrated that diabetic patients with hip fracture had longer lengths of hospital stay and recovered function more slowly.[24]

However, one study[25] found that DM did not influence the mobility or functional ability of the elderly with hip fracture at discharge, but they had higher mortality during hospitalization. Even after undergoing rehabilitation, hip-fractured elders with diabetes still had higher mortality than those without DM after 1 year.[26] Similarly, after an average 23 days rehabilitation, hip-fractured elderly with DM ($n=224$) had significantly poorer physical function than those without DM ($n=738$).[27] In contrast, hip-fractured elders with DM ($n=138$) in another study,[28] after an average 29.6 ± 14.2 days of rehabilitation, had significantly better physical function than those without DM ($n=621$), but their functional gain during rehabilitation did not differ significantly.

Thus, information on how DM influences the outcomes and recovery trajectory after hip fracture is limited and inconsistent. Previous studies focused mostly on exploring mortality and physical function, with little emphasis on other aspects of health outcomes, such as quality of life. Besides, the longitudinal influence of DM on outcomes is still unclear; no studies have explored whether the impact of DM on health outcomes following hip fracture is steady over time and how long the impact lasts. Finally, no studies have examined this phenomenon in Asian or Chinese elders. Therefore, the purpose of this study was to explore and compare the 1-year trajectories in physical functioning, health outcomes, and quality of life for hip-fractured elders with and without DM in Taiwan.

Methods

Study setting and sample

The sample for this study was drawn from three prior studies on hip-fractured elders in Taiwan.[29–31] The first subsample ($n=110$) was drawn from an observational study (1999–2001),[29] and two subsamples were drawn from the control groups of two clinical trials ($n=82$, 50, respectively, conducted from 2001 to 2004, 2005 to 2009).[30,31] All data were collected at the same time points, and all participants were recruited from the same orthopedic wards of a 3,800-bed medical center in northern Taiwan with similar criteria: (1) Age ≥ 60 years, (2) hospitalized due to hip fracture and received surgery, (3) living in northern Taiwan, and (4) Chinese Mini-Mental State Examination (CMMSE) score ≥ 10, indicating without severe cognitive impairment.[32] The three subsamples differed due to participants from the two clinical trials being required to have a prefracture Chinese Barthel Index (CBI) score >70, so they might have had better prefracture performance of activities of daily living (ADLs) than those from the observation study. Furthermore, although all participants received the same care after hip surgery on the same hospital wards, participants in the later studies might have received better care because of improvements in routine care. To reduce bias, participants' membership among the three studies and their prefracture ADL performance were controlled in the analysis. In the final sample ($n=242$), 61 (25.2%) elders had DM and the remaining 181 (74.8%) elders did not.

Procedures

All three studies were approved by the Committee on Human Research at the hospital and were implemented by the same procedure. Researchers identified and invited eligible participants to take part in each study before their discharge. Every participant signed informed consent and was assessed five times—before discharge and at 1, 3, 6, and 12 months after discharge—by face-to-face interviews and observations. Demographic data and cognitive function were obtained before discharge as covariates.

Outcome measures

Recovery in performing ADLs. Walking, bathing, climbing stairs, transferring, grooming, and eating were measured by the CBI.[33] The CBI, with scores ranging from 0 to 100, has had satisfactory reliability and validity for assessing frail elders in Taiwan.[33] Recovery in ADL performance was rated by comparing it with prefracture ADL performance (rated at admission by the CBI via participants' self-report and validated by family members); scores reaching the prefracture level were coded as 1, and those less than the prefracture level were coded as 0.[3] Some ADLs, such as walking and transferring, were rated by actually observing participants' performance. The ADLs of eating and toileting were rated by asking participants/family members.

Recovery in walking ability. Walking ability was assessed by the CBI item that assesses independence in walking.[3] The participants were asked to walk for 50 yards and were rated 0 (immobile or <50 yards), 5 (wheelchair independent, including corners, >50 yards), 10 (walks with verbal or physical help of one person, >50 yards), and 15 (independent, but may use any aid, *e.g.*, a cane, >50 yards). Prefracture walking ability was collected retrospectively at admission, and was compared with postfracture walking ability. If the score of postfracture walking ability was greater than or equal to the score of prefracture, the recovery in walking ability was coded as 1; if not, the recovery was coded as 0.[3]

Health-related quality of life (HRQoL). This was assessed by the Taiwan version of the Medical Outcomes Study Short Form-36 (SF-36).[34–36] The SF-36 consists of 36 items representing eight dimensions, including physical functioning, role disability due to physical health problems, bodily pain, vitality, general health perceptions, social functioning, role disability due to emotional problems, and general mental health. For each subscale (dimension), the score ranges from 0 to 100, with higher scores representing better health outcomes.

Data analysis

The generalized estimating equations (GEE) approach was used to determine whether DM influenced the recovery of elders in performance of ADLs, walking ability, and HRQoL during the first 12 months after discharge for hip fracture. This approach can account for possible correlations and explore differences in repeated measurements over time; another advantage is that it can utilize partial information, *e.g.*, participants with incomplete data can still contribute to the estimation parameters.[37,38] Therefore, this approach is especially useful in longitudinal studies in which sample attrition is inevitable. Thus, in our GEE analysis, data from the elders who died or dropped out within 1 year following discharge ($n=70$) were also included. The GEE modeled dependent dichotomous variables (recovery/no recovery in overall ADL performance and walking ability) and dependent continuous variables (HRQoL measured by the SF-36)—time, gender, age, number of other co-morbidities (obtained from medical records or self-report of elders/families), type of surgery (internal fixation or arthroplasty), prefracture ADL performance, data set membership, and with or without DM were treated as independent variables. All data were analyzed by SAS software (SAS Institute, Inc., Cary, NC).

Elders who gradually dropped out ($n=70$) during the study period, and those who remained in the study did not differ significantly in demographic or outcome variables at the first month, except that those who dropped out were older ($p=0.001$). The major reasons for dropping out were losing contact due to change of address or refusal to continue participating, *i.e.*, not related to participants' mortality or health conditions. Thus, age was controlled as a covariate, and all participants were included in the analysis.

Results

Sample characteristics

Demographic and clinical characteristics of participants with ($n=61$, 25.2%) and without DM ($n=181$, 74.8%) are listed in Table 1. The sample was predominantly female ($n=153$, 63.2%), had a mean age of 78.9 years (standard deviation [SD] = 7.56, range = 63–96), and the majority ($n=145$, 59.9%) had no formal education. The majority of participants ($n=153$, 63.2%) underwent internal fixation, and the average length of hospital stay was 10.6 days (SD = 5.3). The mean prefracture ADL performance was 96.2 (SD = 9.0), with no significant difference between elders with and without DM, indicating that elders in both groups were relatively independent before hip fracture. During the first year after discharge, 27 (11.2%) participants died, with 9 (3.7%) dying within the first month, 8 (3.3%) between months 1 and 3, 3 (1.2%) between months 3 and 6, and 7 (2.9%) between months 6 and 12. In addition, 43 participants dropped out during the first year. Of these dropouts, 8 (3.3%) dropped out in the first month, 8 (3.3%) between months 1 and 3, 8 (3.3%) between months 3 and 6, and 19 (7.9%) between months 6 and 12. Participants who with or without DM did not differ significantly in most characteristic variables, except that those with DM had significantly more ($t=7.89$, $p<0.001$) co-morbidities (M = 2.41, SD = 1.22) than those without DM (M = 1.05, SD = 0.96).

Difference in mortality and service utilization

Within the first year following discharge, hip-fractured elderly with DM had a significantly higher ($\chi^2=5.07$, $p=0.03$) mortality rate ($n=12$, 22.6%) than those without DM ($n=15$, 10.3%). For readmission rate, elders with DM had a significantly higher ($\chi^2=5.22$, $p=0.04$) rate ($n=5$, 10.1%) than those without DM ($n=4$, 2.5%) only during the first to third month after discharge. However, the rates of emergency room visits and institutionalization did not differ significantly at any time point between elders with and without DM (Table 2).

Table 1. Demographic and Clinical Characteristics of Elders with and without Diabetes Mellitus

Characteristic	*With DM (n = 61)*	*Without DM (n = 181)*	p
Age (years), mean ± SD	77.34 ± 7.37	79.44 ± 7.57	0.06
Gender, *n* (%)			0.22
Male	18 (29.5)	71 (39.2)	
Female	43 (70.5)	110 (60.8)	
Hospital stay (days), mean ± SD	11.72 ± 5.87	10.23 ± 5.08	0.08
Educational background, *n* (%)			0.84
Illiterate	35 (57.4)	110 (60.8)	
Primary school	17 (27.9)	41 (22.7)	
High school	6 (9.8)	22 (12.2)	
College or above	3 (4.9)	8 (4.4)	
Type of surgery, *n* (%)			0.45
Arthroplasty	25 (41)	64 (35.4)	
Internal fixation	36 (59)	117 (64.6)	
Number of co-morbidities, mean ± SD	2.41 ± 1.22	1.05 ± 0.96	< 0.001*
Prefracture ADL performance, mean ± SD	94.43 ± 12.69	96.77 ± 7.30	0.21

DM, Diabetes mellitus; SD, standard deviation; ADL, activities of daily living.
*$p<0.001$.

Table 2. Differences in Clinical Outcomes after Hospital Discharge between Elders with and without Diabetes Mellitus

Variable	With DM (n=61)	Without DM (n=181)	p
Mortality, *n* (%)			
Within month 1	2 (3.4)	7 (4.0)	1.00
Within month 3	6 (10.5)	11 (6.5)	0.38
Within month 6	7 (12.5)	13 (8.0)	0.42
Within month 12	12 (22.6)	15 (10.3)	0.03*
ER visits, *n* (%)			
Within month 1	4 (7.3)	16 (9.5)	0.79
Months 1–3	3 (6.0)	8 (5.0)	0.73
Months 3–6	7 (14.0)	13 (8.8)	0.29
Months 6–12	6 (14.3)	7 (5.3)	0.09
Readmission, *n* (%)			
Within month 1	8 (14.3)	15 (8.9)	0.31
Months 1–3	5 (10.0)	4 (2.5)	0.04*
Months 3–6	8 (16.3)	11 (7.5)	0.09
Months 6–12	6 (14.3)	12 (9.2)	0.39
Institutionalization, *n* (%)			
Within month 1	7 (12.5)	8 (4.7)	0.06
Months 1–3	5 (9.1)	7 (4.3)	0.19
Months 3–6	4 (7.8)	3 (2.0)	0.07
Months 6–12	2 (4.9)	3 (2.3)	0.60
ADL recovery, *n* (%)			
Month 1	2 (3.6)	10 (6.0)	0.74
Month 3	6 (12.0)	35 (22.3)	0.15
Month 6	12 (24.0)	63 (42.9)	0.02*
Month 12	21 (51.2)	73 (56.2)	0.59
Walking ability recovery, *n* (%)			
Month 1	12 (21.8)	71 (42.8)	0.006†
Month 3	21 (42.0)	104 (66.2)	0.003†
Month 6	27 (54.0)	106 (72.1)	0.023*
Month 12	29 (70.7)	95 (73.1)	0.840
BP, mean ± SD			
Month 1	62.06 ± 26.47	61.78 ± 23.77	0.95
Month 3	63.07 ± 26.95	73.18 ± 22.81	0.02*
Month 6	74.00 ± 31.81	74.08 ± 24.81	0.99
Month 12	77.29 ± 24.39	72.27 ± 26.14	0.36
GH, mean ± SD			
Month 1	42.54 ± 25.40	58.97 ± 22.11	< 0.001‡
Month 3	42.36 ± 23.41	58.84 ± 23.47	< 0.001‡
Month 6	43.15 ± 24.73	55.53 ± 22.97	0.004†
Month 12	46.93 ± 26.00	51.43 ± 24.82	0.39
VT, mean ± SD			
Month 1	47.08 ± 26.31	54.24 ± 24.19	0.08
Month 3	50.12 ± 19.30	61.80 ± 21.06	0.002†
Month 6	56.67 ± 22.86	62.66 ± 19.56	0.11
Month 12	55.54 ± 21.70	59.54 ± 21.21	0.38
SF, mean ± SD			
Month 1	51.30 ± 30.21	52.86 ± 30.23	0.76
Month 3	55.95 ± 28.19	61.71 ± 27.36	0.24
Month 6	60.26 ± 31.00	68.13 ± 28.56	0.14
Month 12	69.40 ± 28.07	69.14 ± 29.67	0.97
RE, mean ± SD			
Month 1	54.17 ± 45.93	59.43 ± 45.38	0.49
Month 3	66.67 ± 44.78	82.16 ± 35.21	0.04*
Month 6	72.65 ± 41.80	63.21 ± 34.44	0.16
Month 12	79.77 ± 39.90	87.04 ± 31.85	0.38
MH, mean ± SD			
Month 1	51.67 ± 23.22	59.45 ± 21.18	0.03*
Month 3	60.57 ± 22.01	66.90 ± 19.84	0.08
Month 6	64.21 ± 21.34	67.16 ± 19.70	0.42
Month 12	62.43 ± 23.51	67.05 ± 21.07	0.31

(*continued*)

Table 2. (Continued)

Variable	With DM (n=61)	Without DM (n=181)	p
PF, mean ± SD			
Month 1	10.83 ± 15.65	15.00 ± 18.97	0.17
Month 3	20.60 ± 22.26	30.87 ± 26.43	0.02*
Month 6	31.38 ± 23.18	42.48 ± 28.73	0.03*
Month 12	35.67 ± 28.73	47.66 ± 31.50	0.06
RP, mean ± SD			
Month 1	12.5 ± 31.37	11.02 ± 28.15	0.76
Month 3	15.48 ± 28.13	26.58 ± 38.50	0.04*
Month 6	30.00 ± 38.48	31.15 ± 40.11	0.87
Month 12	44.83 ± 48.36	42.27 ± 43.47	0.78

$^{*}p < 0.05$; $^{\dagger}p < 0.01$; $^{\ddagger}p < 0.001$.

DM, diabetes mellitus; ER, emergency room; ADL, Activities of daily living; BP, bodily pain; SD, standard deviation; GH, general health perceptions; VT, vitality; SF, social functioning; RE, role limitations due to emotional problems; MH, general mental health; PF, physical functioning; RP, role limitations due to physical health problems.

The influence of DM on physical function recovery and HRQoL

The clinical outcomes (recovery rates for ADL performance and walking ability, scores for various dimensions of HRQoL) for hip-fractured elders with and without DM at various times after hospital discharge are presented in Table 2. After controlling for prefracture ADL performance (CBI score) as a covariate in analysis, elders with DM had significantly poorer recovery in ADL performance, walking ability (Fig. 1), and most dimensions of HRQoL during the first 6 months following discharge.

Further GEE analysis (Table 3) showed the trends in recovery for all elders. Compared to their performances in the first month, all elders significantly improved 3, 6, and 12 months after discharge, as shown in their recovery trends.

Moreover, the GEE analysis showed the negative influence of DM during the first year after discharge. Elders without DM had significantly better recovery ($\beta = 0.79$; $p = 0.02$) and a 2.2 times (CI = 1.15–4.21) greater odds of recovering their walking ability than those with DM, but the two groups did not differ significantly in recovery of ADL performance. Regarding the influence of DM on recovery trajectories of HRQoL, elders without DM had significantly better health outcomes than those with DM in general health ($\beta = 9.33$; $p = 0.01$) and physical functioning ($\beta = 7.26$; $p = 0.02$) during the first year, but the two groups did not differ significantly in other dimensions of HRQoL.

Discussion

This is the first longitudinal study to evaluate the impact of DM on both physical recovery and HRQoL in Asian elders following hip fracture. We found that DM negatively impacts the recovery of ADL performance, walking ability, and various health outcomes, especially during the first 6 months following discharge. This finding is consistent with previous reports[23,27] that physical function after hip fracture is poorer in patients with DM than those without DM, with similar findings on the magnitude of influencing effects. We also

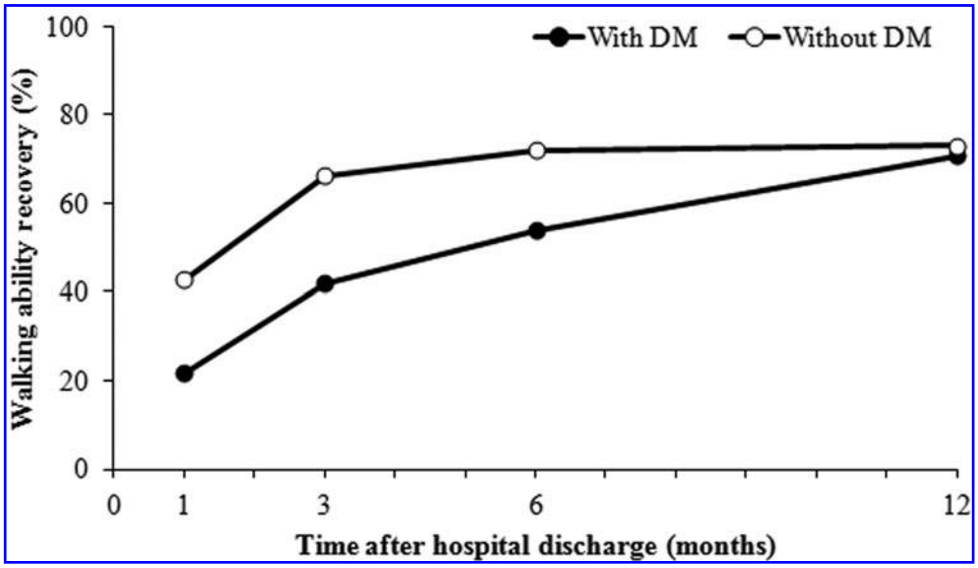

FIG. 1. Recovery in walking ability between diabetes mellitus (DM) and without-DM groups.

found that hip-fractured elders with DM had more co-morbidities and higher mortality than those without DM, as previously reported.[22,28] In addition, we found that hip-fractured elders with DM had a higher readmission rate during the first 3 months following discharge. Unfortunately, we did not have enough information on the reasons for readmission to determine if readmissions were related to DM or not.

However, we found that outcomes in both physical recovery and HRQoL did not significantly differ between elders with and without DM in the 12 months after fracture. Hip-fractured elders with DM seemed to have greater improvement in recovery during the 6^{th} to 12^{th} months after discharge, suggesting that DM mainly negatively influenced hip-fractured elders during the first 6 months after surgery, with its influence gradually diminishing thereafter. This phenomenon might be due to the majority of the elders in our research ($n = 132$, from two clinical trials) having good prefracture functional abilities and cognitive function, so they gradually recovered well after a long time. Nevertheless, we do not think that the outcomes of recovery in elders with or without DM will finally reach the same levels. We believe that the elders with DM still needed more care during the recovery period, especially during the first

Table 3. Generalized Estimating Equations Analysis of Influence of Diabetes Mellitus on Recovery in Physical and Mental Functioning During the First Year after Discharge

	Time after discharge (months)			
Outcome variable	*3*	*6*	*12*	*With vs. without DM*
ADL recovery	1.55‡ (OR = 4.71) (CI = 2.47–9)	2.53‡ (OR = 12.55) (CI = 6.32–24.93)	3.22‡ (OR = 25.03) (CI = 11.88–52.71)	0.39 (OR = 1.48) (CI = 0.7–3.11)
Walking recovery	0.98‡ (OR = 2.66) (CI = 1.88–3.75)	1.28‡ (OR = 3.59) (CI = 2.45–5.27)	1.63‡ (OR = 5.11) (CI = 3.31–7.87)	0.79* (OR = 2.2) (CI = 1.15–4.21)
BP	7.93‡	10.99‡	11.67‡	1.26
GH	−1.89	−4.59*	−5.92*	9.33†
VT	5.53†	6.93‡	3.75	5.57
SF	8.18†	13.09‡	17.99‡	1.28
RE	19.35‡	19.53‡	26.36‡	7.31
MH	7.21‡	7.23‡	6.07†	3.81
PF	13.80‡	23.65‡	29.33‡	7.26*
RP	12.78‡	19.35‡	31.19‡	4.09

Time uses 1-month data as baseline. With versus without DM uses DM group data as baseline. Regression coefficients were obtained after controlling for time, gender, age, number of co-morbidities, type of surgery, education, prefracture ADL, and dataset membership. Odds ratios were calculated only for categorical outcome variables.

*$p < 0.05$; †$p < 0.01$; ‡$p < 0.001$.

DM, Diabetes mellitus; ADL, activities of daily living; OR, odds ratio; CI, confidence interval; BP , bodily pain; GH, general health perceptions; VT, vitality; SF, social functioning; RE, role limitations due to emotional problems; MH, general mental health; PF, physical functioning; RP, role limitations due to physical health problems.

6 months after their discharge. The higher readmission rate and less recovery in ADL performance and walking ability of elders with DM will influence their quality of life and result in higher mortality after discharge. These findings cannot be ignored.

Our results add to the relevant literature by clarifying the trajectory of functional recovery after hip fracture in elders with and without DM. This trajectory had not clearly been explored in previous studies, possibly due to different approaches to data analysis and the duration of follow-up.

Our findings highlight that, although hip-fractured elders with DM had worse recovery after discharge than those without DM, after a long period of time, hip-fractured elders with DM might still recover as well as those without DM. This result reminds clinicians to pay more attention to hip-fractured elders with DM, especially during the first 6 months after discharge. Intervention protocols, particularly for recovery in mobility, ADLs, and various functional outcomes may need to be developed for these elders.

This study compared longitudinal changes in HRQoL and physical recovery in a Taiwanese sample of elderly hip-fractured patients with and without DM. The generalizability of the study findings is limited by possible influencing factors for which we did not collect data. For example, we did not collect data on factors such as time since diagnosis with DM, severity of DM, whether participants used a medication or insulin, and how well DM was controlled. The generalizability might also have been limited by participant attrition ($n=70$, 29%). Moreover, the results might have been biased by obtaining participants' prefracture ADL performance from their recall, although it was validated by family members. Because participants' prefracture HRQoL was not measured, we cannot precisely know if the health status of elders with and without DM was similar before hip fracture or they had a worse start after discharge. However, any differences in the prefracture condition of both groups might have been minimized by controlling their prefracture CBI scores as a covariate in the analysis. In addition, due to the sample selection criteria, the participants in this study may have been relatively more independent before hip fracture than the general population of hip-fractured elders. Elders with severe cognitive impairment and physical disability before fracture were also excluded from the study. All of these were limitations of this research. Thus, the findings can only be generalized to elders in Taiwan who were independent before hip fracture.

These study results raise several issues. Does the length of DM history influence recovery after hip fracture? How do severity and complications of DM influence outcomes following hip fracture? These questions could be further explored and could serve as the foundation for interventional studies.

Conclusion

DM negatively impacted the recovery of outcomes in Taiwanese elders following hip fracture. DM not only influenced their mortality and physical functions, but also compromised their recovery of ADL performance, walking ability, and various dimensions of HRQoL, although the influences of DM seemed to gradually diminish in some health dimensions. Because the elderly Asian population is rapidly growing in Western countries,[39] the results of this study could provide a reference for health-care providers in countries that have to deal with elderly Chinese/Taiwanese hip-fractured elders with DM.

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