Title. Older people with hip fracture: depression in the postoperative first year.

Aim. This paper is a report of a study conducted to describe changes in risk of depressive symptoms and their predictors for older people with hip fracture during the first year following hospital discharge.

Background. The prevalence of depression in older people with hip fracture has been reported as 9–47%. However, the longitudinal changes in prevalence rate following hip fracture have not been well-studied, particularly in Asian countries.

Methods. The study was conducted in Taiwan in 2001–2003. A sample of 147 older people with hip fracture was assessed for depressive symptoms before discharge, and at 1, 3, 6 and 12 months after discharge using the Chinese version of the Geriatric Depression Scale. Longitudinal data were analysed by the generalized estimating equation approach.

Findings. The majority of participants were at risk for depressive symptoms before discharge \( (n = 147, 57.8\%) \) and 35.6\% \( (n = 118) \) 12 months after discharge. These numbers decreased statistically significantly from before discharge to the 1st month after discharge \( (57.8\% \text{ vs. } 42.6\%, P = 0.008) \), and from the 1st to the 6th month \( (42.6\% \text{ vs. } 31.3\%, P = 0.03) \), and then remained stable until the 12th month after discharge. Lower emotional-social support predicted persistent depressive symptoms after discharge \( (P < 0.01) \).

Conclusion. Timely psychological interventions are suggested within the first 6 months after discharge, especially the first 3 months. Healthcare professionals need to pay attention to older patients with hip fracture who are female, with poorer prefracture functioning and particularly those with lower emotional-social support.

Keywords: depression, gerontology, hip fracture, nursing, older people

Introduction

Hip fracture, one of the most severe consequences of osteoporosis, has been associated with high rates (9–47%) of depression in older people (Holmes & House 2000); these are higher than rates (2.3–25%) for the same age group living in the community (Djernes 2006). At the same time, depression has been found to affect rehabilitation, morbidity
and mortality in patients with hip fracture (Mossey et al. 1990, Ostir et al. 2002). These data suggest that depression after hip fracture in older adults has become an important issue for healthcare professionals.

The postoperative prevalence of depression for older people with hip fracture has been well-studied (Holmes & House 2000). However, few researchers have explored the prevalence and incidence rate beyond 3 months (Mossey et al. 1990, Shepherd & Prescott 1996, Voshaar et al. 2007), indicating a lack of longitudinal studies on the recovery curves for depressive prevalence after hip fracture.

Furthermore, the majority of studies on the prevalence of depression after hip fracture have been conducted in Western countries, and little is known about this phenomenon in Asian countries. The external validity of these observations must be evaluated with data from other societies and cultures, as ethnic and cultural differences have been found in the prevalence of depression (Kleinman 2004, Plant & Sachs-Ericsson 2004).

To fill these gaps in knowledge, we designed this study to describe the incidence, recovery rate and postoperative trends for risk of depressive symptoms and its predictors for a sample of older patients with hip fracture in Taiwan during the first 12 months following hospital discharge. We hypothesized that the prevalence rate of risk for depressive symptoms among older people with hip fracture would decrease during the first 12 months after hospital discharge.

Background

The population of Taiwan aged 65 and older is projected to increase from 10.4% in 2008 to 16.2% in 2020 and to 35.9% in 2050 (Council for Economic Planning and Development, Executive Yuan 2008). As in other countries with increasingly ageing populations, Taiwan faces the major and growing healthcare problem of hip fracture. The age-adjusted incidence rates of hip fracture for men and women in Taiwan were found to be 225 and 505 per 100,000 in 1996–2000, respectively, which was higher than rates found in China and similar to those of Western countries (Chie et al. 2004). Furthermore, a large percentage of older Taiwanese patients with hip fracture do not recover their prefracture function. Indeed, we found that, among 110 older Taiwanese people with hip fracture, 56.1% had recovered their overall performance of physical activities of daily living (ADLs), 37.9% had recovered their overall instrumental ADLs and 74.2% could walk independently or with a cane 12 months following discharge (Shyu et al. 2004a).

Depressive symptoms are common in older people with illness (Alexopoulos 2005). Moreover, mental health status has been found to predict outcomes such as poor functional recovery and high mortality (Mossey et al. 1990, Fenton et al. 1994, Holmes & House 2000, Pouget et al. 2000). For example, patients at persistent risk for depression were found in our previous study to have much less chance of recovering performance of ADLs (OR = 0.16, CI = 0.06–0.42) and walking ability (OR = 0.09, CI = 0.04–0.21) than those at no risk for depression during the first year following hospital discharge (Shyu et al. 2008). Therefore, depression in older people with hip fracture is an important health issue. Interventions to prevent and manage depression in this population may decrease mortality and facilitate functional recovery following hip fracture.

Although the prevalence of depression after hip fracture has been well-studied (Holmes & House 2000), most researchers have explored this prevalence during patient hospitalization (Magaziner et al. 1990, Holmes 1996) or within 3 months after hip fracture (Billig et al. 1986, Strain et al. 1991, Zimmerman et al. 1999). In one 6-month study that explored the incidence rate of depression following hip fracture, the cumulative incidence rate was 16.8% at 6 weeks, 19.5% at 3 months and 20.5% at 6 months (Voshaar et al. 2007). Two research teams explored the prevalence and trajectory of depression up to 1 year following hip fracture (Mossey et al. 1990, Shepherd & Prescott 1996). In the first study (Mossey et al. 1990), 196 white females with persistent depressive symptoms (measured after hip-fracture surgery and 2, 6 and 12 months later) were statistically significantly less likely than patients with few depressive symptoms to recover physical function. In the second study (Shepherd & Prescott 1996), among older people with hip fracture assessed for depressive symptoms and functional status at baseline (time of fracture) and 1, 6 and 12 months later, 31% were classified as depressed at baseline and this proportion rose to 36% at 1 year. However, in neither study were the longitudinal changes in prevalence rate fully described, nor were they estimated by longitudinal analysis. Using longitudinal data analysis would allow changes in the recovery curve of depressive symptoms to be more precisely captured.

More importantly, most studies on depressive symptoms following hip fracture have been conducted in Western countries (Holmes & House 2000). Taiwan differs substantially from Western countries in its healthcare system, clinical practice, case-mix, culture and social organization. For example, unlike the United States of America (USA), Taiwan has national health insurance that gives its citizens the choice to visit clinics in a medical centre without referral. At the same time, around 64-3% of older people in Taiwan live with their children, whereas only one-fifth and one-quarter live...
with an adult child in the USA and Europe, respectively (Department of Statistics, Ministry of the Interior 2005, Pezzin et al. 2007). Chinese culture emphasizes devotion to parents, social orientation and interdependence, whereas Western culture values autonomy and independence and does not encourage oversacrifice for parents (Dai & Dimond 1998). These health care and cultural differences may lead to differences in depressive symptoms following hip fracture for older people in Taiwan and in Western countries. As ethnic and cultural differences are known to play a role in depression (Kleinman 2004, Plant & Sachs-Ericsson 2004), cross-validation and extension of prior observations from Western studies may provide useful information to guide clinical practice with Asian populations.

The study

Aim

The aim of the study was to describe changes in risk of depressive symptoms and their predictors for older people with hip fracture during the first year following hospital discharge.

Design

A prospective, longitudinal study design was used and the data were collected in 2001–2003.

Participants

A convenience sample was recruited from the trauma wards of a typical 3000-bed medical centre in Taiwan. The inclusion criteria were: (i) age 60 years or older, (ii) hospitalized for hip fracture, (iii) surgery for internal fixation or arthroplasty, (iv) no severe cognitive impairment (Chinese Mini-Mental State Examination (CMMSE) score <10, Yip et al. 1992, Shyu & Yip 2001) and (v) able to walk independently before the fracture.

Of 298 patients who met these criteria, 158 agreed to participate. The numbers at each data collection point is described in Figure 1. Of the 158 patients who agreed to participate, only 147 completed the Geriatric Depression Scale short form (GDS, Burke et al. 1991) before discharge. At the end of 12 months, only 118 people remained in the study. The reasons for loss to follow-up after discharge were mortality (n = 8, 5.4%) and refusal or inability to complete the GDS (n = 21, 14.3%).

The sample size calculation was based on McNemar’s test, which is used to test two proportions for a given variable obtained from the same participants. The two proportions in this study were the prevalence of depression among older people with hip fracture before and 12 months after hospital discharge. The sample size required to achieve a power of 90% at 0.05 statistical significance was 126. This estimate was based on the 58% prevalence of depression before hospitalization in this study (85/147), an estimated 40% prevalence after 1 year. The estimated 1-year prevalence of depression was based on reports for older people with hip fracture around 33% (Holmes & House 2000), for community-dwelling older people in Taiwan of 15% (Chong et al. 2001), thus we estimated a 18% decrease in prevalence. In addition, we estimated a 15% likely loss to follow-up. Therefore, we recruited 147 patients.

In terms of rehabilitation, these patients are usually taught by nurses during the first 2–3 days after surgery how to exercise in bed and change position. Patients also receive pain-relief medication for 2–7 days and antibiotics for 2 or 3 days. On the 3rd day after surgery, physical therapy usually starts once a day by learning to use a walker and get in/out of

Figure 1 Flow chart of the study.
bed. At around 7 days after surgery, patients are usually discharged from the hospital without in-home rehabilitation.

**Data collection**

Data on depressive symptoms were collected by face-to-face interviews prior to discharge (in hospital) and at 1, 3, 6 and 12 months after hospital discharge (at participants’ homes). Prior to discharge, data were also collected on demographic variables and cognitive status (CMMSE); at the 1st month after discharge, data were also collected on emotional support. Patients who refused to participate at admission \((n=140)\) and those who agreed to participate \((n=158)\) were not statistically significantly different in terms of gender, age, type of surgery, literacy, concomitant diseases, prefracture performance of ADLs and CMMSE scores.

**Study variables**

**Dependent variable: depressive symptoms**

Depressive symptoms were assessed by the Chinese version of the GDS short form (Burke et al. 1991). The total score on the GDS short form ranges from 0 to 15, with higher scores representing more depressive symptoms (Burke et al. 1991). The internal consistency reliability and construct validity of the GDS short form have been established among older Taiwanese people (Liu et al. 1998). In this study, Cronbach’s \(\alpha\) ranged from 0.82 to 0.86.  

**Predictor variables**

Predictors of changes in depressive symptoms were gender, age, concomitant illnesses, prefracture performance of ADLs, education (literate or illiterate), emotional-social support and cognitive status. The number of concomitant illnesses (e.g. cancer, stroke, heart, renal or liver disease, diabetes mellitus, osteoporosis or dementia) was collected from medical records.

Prefracture performance of ADLs was measured by participants’ self-report on the Chinese Barthel Index (CBI) (Chen et al. 1995). The CBI assesses dependencies in eating, transferring, grooming, toileting, bathing, walking, climbing stairs, dressing, bowel and bladder control. Scores can range from 0 (total dependence) to 100 (total independence). The CBI inter-rater reliability was reported as 0.94, and internal consistency ranged from 0.89 to 0.92 (Hsu et al. 2001). In this study, Cronbach’s \(\alpha\) for the CBI was 0.93.

Cognitive function was measured by the CMMSE (Yip et al. 1992, Shyu & Yip 2001), which was translated from the English version MMSE (Folstein et al. 1975), the most widely used tool for assessing cognitive impairment. The CMMSE contains 30 dichotomous items with a total score of 30. Interrater agreement higher than 0.90 and satisfactory construct validity have been reported for the CMMSE (Shyu & Yip 2001, Lou et al. 2003).

Emotional-social support was measured by 11 items from the Medical Outcome Study (MOS) social support survey (Sherbourne & Stewart 1991). The reliability and validity of the MOS social support survey have been established in a Taiwanese sample (Shyu et al. 2006). In Shyu et al.’s (2006) study, Cronbach’s \(\alpha\) coefficients of 0.85 and 0.97 were found for different subscales and the construct validity of different subscales was supported by mild-to-moderate (0.19;0.35) positive relationships with spirituality and general health measures. The 11 items that selected from the MOS social support survey used in this study represent three dimensions of support: emotional support (four items), informational support (four items) and affective support (three items). Each item is rated by how often the support was available if needed: 1 – response options are never; 2 – a little of the time; 3 – some of the time; 4 – most of the time; 5 – always. Scores for each subscale are summed algebraically. Total scores can range from 11 to 55, with higher scores indicating more emotional-social support. In this study, Cronbach’s \(\alpha\) coefficient was 0.95.

**Data analysis**

Descriptive statistics were used to describe the demographics. The generalized estimating equations (GEE) (Liang & Zeger 1986, 1993) approach was used to determine whether changes in the proportion of older people with hip fracture at risk for depressive symptoms were statistically significantly different at different times during the first year following hospital discharge. The GEE can account for possible correlations in repeated measures over time and is suitable for exploring differences in values measured at different times. The GEE was used in this study to model dependent dichotomous variables, risk of depression as a function of time, gender, age, literacy/illiteracy, concomitant diseases, prefracture performance of ADLs, need for emotional-social support and cognitive function.

We also used multiple logistic regression to explore predictors for persistent risk of depressive symptoms (GDS score \(\geq 5\) at two or more time points after discharge) among patients at risk before discharge and to examine predictors of occurrence of risk of depressive symptoms among patients not at risk before discharge. All data were

Results

Risk of depressive symptoms

The sample demographics are listed in Table 1. The incidence rates for depressive symptoms of participants not at risk for depressive symptoms were 25.8% from before discharge to the 1st month after discharge, 21.3% between the 1st and 3rd months, 13% between the 3rd and 6th months and 16.5% between the 6th and 12th months after discharge. The recovery rates for those at risk for depressive symptoms were 42.4% from before discharge to the 1st month after discharge, 28.3% between the 1st and 3rd months, 37.5% between the 3rd and 6th months and 22.5% between the 6th and 12th months after discharge (data not shown).

Longitudinal changes in the prevalence of risk for depressive symptoms analysed by the GEE approach are presented in Table 2. The first and second rows show the marginal prevalence at each time and differences in prevalence between any two time points respectively. Among all participants, 57.8% were at risk for depression (GDS score ≥5) before discharge, 42.6% at the 1st month after discharge, 41.3% at the 3rd month, 31.3% at the 6th month and 35.6% at the 12th month. When ‘before discharge’ was used as the baseline, those at risk for depressive symptoms decreased statistically significantly between baseline and the 1st month (57.8% vs. 42.6%, P = 0.008), the 3rd month (57.8% vs. 41.3%, P = 0.004), the 6th month (57.8% vs. 31.3%, P < 0.001) and the 12th month after discharge (57.8% vs. 35.6%, P = 0.001). When ‘1st month after discharge’ was used as baseline, the percentage decreased statistically significantly from the 1st to 6th month after discharge (42.6% vs. 31.3%, P = 0.03). The percentage at risk for depression decreased statistically significantly from before discharge to the 6th month after discharge, and then remained stable from the 6th to the 12th month after discharge.

Predictors of risk for depressive symptoms

For overall predictive trends in patients at risk for depressive symptoms, those who were female (P < 0.001), with lower prefracture performance of ADLs (P < 0.001) and with lower emotional-social support (P < 0.001) were more likely to be at higher risk for depressive symptoms. For patients at risk for depressive symptoms before discharge (n = 85), 44 had persistent depressive symptoms (GDS ≥5 at 2 or more time points after discharge). After adjusting some covariates in the logistic model, lower emotional-social support was the only predictor for persistent depressive symptoms after discharge (P < 0.01). Among patients not at risk for depressive symptoms before discharge (n = 62), 26 were at risk for depressive symptoms after discharge. However, none of the predictors in the model was statistically significantly associated with depressive symptoms after discharge. The possibility of multicollinearity in these two logistic models was negligible as a stepwise selection was adopted and the standard errors in each step were small.

Discussion

Study limitations

This study had some limitations. First, participants were recruited as a convenience sample. Secondly, prefracture risk for depression was not assessed. Thirdly, several participants were lost to follow-up, so that the study might be underpowered. Fourthly, patients with severe mental impairment and physical disability prior to the fracture were excluded. Thus, the findings of this study can only be generalized to the
population of older people in Taiwan who were independent prior to their hip fracture.

Discussion of results

This study is the first to describe the recovery curve in prevalence of risk for depressive symptoms in a sample of Chinese older people with hip fracture. These results on the trajectory for prevalence of depression risk may help healthcare providers to predict more precisely the psychological condition of patients with hip fracture, thus providing a reference for timing assessments and interventions. Our results indicate that the rate of depression risk ranged from 41.3% to 57.8% during the first 3 months after hip surgery, which is higher than the 9–47.5% rates reported in Western studies (Holmes & House 2000, Rozzini et al. 2007, Bellelli et al. 2008) on prevalence of depression during the hospitalization or subacute phase. On the other hand, 1 year following hospital discharge, the prevalence rate in our study decreased to 35.6%, which is close to the 36% reported by Shepherd and Prescott (1996). We also found an incidence rate above 20% from before discharge to the 1st month after discharge and from the 1st to 3rd month after discharge. This is higher than the 20.5% postoperative, cumulative incident of depression found in a European sample of older people with hip fracture (Voshaar et al. 2007). In other words, the prevalence and incidence rate of risk for depression during the acute and subacute phases for older people with hip fracture following surgery were higher in this study than in those conducted in Western countries. These differences may be due to ethnic and cultural factors (Kleinman 2004, Plant & Sachs-Ericsson 2004). Another possible explanation for the different rates in depression risk may be the different methodological approaches used and these issues will need to be further examined.

The prevalence of risk for depressive symptoms varied over time, with statistically significant decreases occurring within 6 months after discharge. This finding is consistent with a previous report that most of the improvement in mental health-related outcomes occurred within the first 3–6 months after discharge (Shyu et al. 2004b). This phenomenon might also be due to the inverse correlation between depressive symptoms and physical functioning (Lieberman et al. 1999, Ostir et al. 2002), as most recovery of physical functioning occurs during the first 6 month after discharge (Shyu et al. 2004a,b).

In terms of overall predictive trends in patients at risk for depression, we found that those who were female, had lower prefracture ADL performance and had lower emotional-social support were more likely to be at higher risk for depression. This finding is supported by previous reports that being female, disabled before the hip fracture (Lieberman et al. 1999) and with lower emotional-social support (Chou & Chi 2003, Li et al. 2003) predicted more depressive symptoms. In terms of predictors for persistent depressive symptoms, we found that, after controlling for other variables, the only predictor was lower emotional-social support. Racial differences in social resources and social support have been recognized and addressed extensively (Johnson & Tripp-Reimer 2001, Williams & Wilson 2001), but there is little empirical evidence about the influence of social support on the health and well-being of older Asian people. Asian older people have been viewed as very family-oriented and less likely to live alone than older populations in Western countries. Most of the older participants (92%) in this study lived with their family members, similar to other frail older people in Taiwan (Directorate-General of Budget 1997). The emphasis in Chinese culture on social orientation and interdependence among family members (Dai & Dimond 1998) might increase the importance of emotional-social support.
What is already known about this topic
- High rates of depression have been reported in Western samples of older people with hip fracture.
- Depression affects rehabilitation, morbidity and mortality in people with hip fracture.

What this paper adds
- The majority of participants were at risk for depressive symptoms before discharge.
- These numbers decreased statistically significantly from before discharge to the 6th month and remained stable until the 12th month after discharge.
- The predictors of prevalence of risk for depression during the first year after discharge were being female, having poor prefracture functioning and having low emotional-social support.

Implications for practice and/or policy
- Timely interventions are suggested during the first 6 months after discharge, especially in the first 3 months.
- Healthcare professionals need to pay more attention to patients who are female, with poorer prefracture function and particularly those with lower emotional-social support.

Conclusion
In summary, the prevalence of risk for depression appeared to be high in this sample of Taiwanese older people. These findings have several implications for nursing care. First, nurses should assess older patients for risk of depression during the first year following surgery for hip fracture. Timely psychological interventions are suggested within the first 6 months after discharge, especially the first 3 months. Secondly, nurses need to pay more attention to high-risk groups such as women, those with poor prefracture function and particularly those with low emotional-social support.

The results also suggest the need for further exploration of several issues. For example, what is the prevalence of depression for older people with severe cognitive and physical impairment before hip fracture? How do longitudinal changes in depression after hip fracture differ among different ethnic groups? Interventional studies based on the findings of the present study may prove useful. As the population of Asian older people is increasing rapidly in Western countries, our results may provide a reference for healthcare providers in those countries with relatively large Chinese/Taiwanese immigrant populations.

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Conflict of interest
No conflict of interest has been declared by the authors.

Author contributions
YILS, HSC, HCT and CCW were responsible for the study conception and design. HSC, HCT and CCW performed the data collection. YILS, HCT and MCC performed the data analysis. YILS, HSC, HCT, MCC, CCW and WCT were responsible for the drafting of the manuscript. YILS made critical revisions to the paper for important intellectual content. MCC provided statistical expertise. YILS obtained funding. YILS supervised the study. YILS, HSC, HCT, MCC and WCT provided other contributions.

References


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