Archives of Gerontology and Geriatrics 79 (2018) 116–122

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Different impacts of dementia on two-year mortality after osteosynthesis and hemiarthroplasty in treating geriatric hip fractures

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ARTICLE INFO

Keywords:
Dementia
Geriatric hip fracture
Mortality
Internal fixation
Hip hemiarthroplasty

ABSTRACT

Background: Geriatric hip fractures are mostly managed by internal fixation (IF) or hemiarthroplasty (HA). Survivorship of dementia patients following these surgeries has not been extensively compared in literature. By analysis of nationwide database, this study aimed to investigate the impact of dementia on two-year mortality after IF and HA in treating geriatric hip fractures.

Method: From retrospective review of Taiwan's National Health Insurance Research Database, we enrolled 153,623 subjects aged 65 years and older with hospitalization for first hip fracture operated by IF (93,029 cases) or HA (60,594 cases) between 2000 and 2011. Postoperative mortality was compared between subjects with and without dementia after adjustments of age, gender, Charlson comorbidity index and hospital level.

Results: The prevalence of dementia was 5.24% in the IF and 5.29% in the HA group. In the IF group, dementia increased adjusted hazard ratio of one-year (1.06, 95%CI:1.00–1.13) and two-year mortality (1.10, 95%CI:1.05–1.16). However, short and long-term mortality following HA was not significantly impacted by dementia (in-hospital OR:0.79, 95%CI:0.60–1.03; three-month HR:0.99, 95%CI:0.87–1.12; one-year HR:1.01, 95%CI:0.93–1.10; two-year HR:1.03, 95%CI:0.96–1.09). In a subgroup of dementia patients, mortality following IF was 15% higher than HA in one ($p = 0.004$) and two years ($p < 0.001$). The negative prognostic factors included female (HR:1.10; 95%CI:1.03–1.18) and aging 65–84 years (HR:1.15; 95%CI:1.00–1.32).

Conclusion: Dementia increased one and two-year mortality following geriatric hip fracture treated by IF, rather than HA. Dementia patients undergoing HA, especially female or 65–84 years old, sustained better one and two-year survival than those receiving IF.

1. Introduction

Because of the ageing global population (Newgard & Sharpless, 2013), the prevalence of dementia is increasing in developed countries (Doblhammer, Fink, & Fritze, 2015; Mathillas, Lovheim, & Gustafson, 2011; Rocca et al., 2011; Wiberg, Waern, Billstedt, Ostling, & Skoog, 2013). In addition to cognitive impairment from neurodegeneration, dementia is associated with numerous comorbidities, polypharmacy, and increased use of hospital services (Andersen, Viitanen, Halvorsen, Straume, & Engstad, 2011; Sampson, Blanchard, Jones, Tookman, & King, 2009; Xie, Brayne, Matthews, Medical Research Council Cognitive, F., Ageing Study, & C., 2008). Compared with those of cognitively unimpaired people, hospitalisation rates are three times higher and lengths of hospital stay are twice as long in patients with dementia (Draper, Karmel, Gibson, Peut, & Anderson, 2011; Pinkert & Holle, 2012). Despite the burden of substantial costs for the health care system, patients with dementia have higher in-hospital mortality rates and lower life expectancy (Marengoni et al., 2011; Tom et al., 2015).

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https://doi.org/10.1016/j.archger.2018.08.011
Received 14 July 2018; Received in revised form 22 August 2018; Accepted 27 August 2018
Available online 28 August 2018

Injury is one of the most common causes of hospitalisation for patients with dementia (Australian Institute of Health & Welfare, 2012). Dementia carries the risk of falling for elderly people because of impaired perception of safety, limited attention span, and lack of body awareness (Lach, Harrison, & Phongphanngam, 2016; McGilton et al., 2007). Because of the strong connection between dementia and osteoporosis in epidemiology and pathophysiology (Chang et al., 2014; Yamaguchi, 2015), people with dementia are more vulnerable to hip fracture than those without (Draper et al., 2011; Huang, Lin, Liou, & Lin, 2015). The mortality rate is higher in patients with dementia 30 days, 90 days, and 1 year after hip fracture, likely because of pulmonary and cardiac morbidities (Fansa, Huff, & Ebraheim, 2016; Mitchell, Harvey, Brodaty, Draper, & Close, 2016).

Most cases of osteoporotic hip fracture are femoral neck and intertrochanteric fractures (Yin et al., 2015), for which various surgical management techniques have been proposed. These techniques can be categorised as hemiarthroplasty (HA) or internal fixation (IF). Because of the distinct biomechanical features and healing processes of HA and IF, the postoperative protocols for weight bearing following these procedures vary. Several studies reported that patients treated with HA were able to begin partial and full-weight bearing earlier than those underwent IF (Kayali, Agus, Ozluk, & Sanli, 2006; Kim, Lee, Kong, & JeaGal, 2012; Kim, Hur, Hwang, Choi, & Kim, 2014; Tang, Hu, Shen, Zhang, & Zhang, 2012). For elderly people with fragility hip fractures, the postoperative ambulatory level could serve as a predictor of mortality (Kadowaki, Kono, Nishiguchi, Kakimaru, & Uchio, 2012). At the time of discharge, patients able to walk with or without aid have lower 1-year mortality than that of patients unable to walk (Kadowaki et al., 2012). However, adherence to a weight bearing protocol and rehabilitation program is usually compromised in patients with dementia (McGilton et al., 2007). The most obstructive cognitive symptoms are memory problems, lack of insight and judgment, and loss of purposeful movements (McGilton et al., 2007). Given the difference in timing of full weight bearing between HA and IF, dementia might unequally impact the ambulatory level recovery and the mortality rate following these procedures. Despite the association between dementia and increased short- and long-term mortality following hip fracture (Fansa et al., 2016; Mitchell et al., 2016), whether the postoperative mortality rates of HA and IF increase comparably in patients with dementia has not yet been extensively investigated. We used the National Health Insurance Research Database (NHIRD) of Taiwan to implement a nationwide cohort study investigating the effects of dementia on postoperative mortality following HA and IF. We hypothesised that dementia increases the postoperative mortality of patients with geriatric hip fracture treated through HA and IF in equal measure.

2. Materials and methods

2.1. Database

The National Health Insurance (NHI) program in Taiwan was established in 1995. With 23 million enrolees, the program currently covers more than 99% of the population of Taiwan. According to the health care protocol, all data on reimbursements from health insurance are reported to Taiwan's Bureau of National Health Insurance (BNHI) in standard computerised form. The data in the NHIRD are provided by the BNHI and are derived from records of insurance claims. The NHIRD contains encrypted patient identification data, data on patient characteristics, and information from medical records such as diagnosis codes, procedures, and prescriptions. All diagnoses and procedures are coded based on the International Classification of Diseases, Ninth Revision, Clinical Modification/Procedure Coding System (ICD-9-CM/PCS).

2.2. Study design and population

This retrospective cohort study was approved by the institutional review board at our institute and analysed claims data from the NHIRD for the period between January 2000 and December 2011. The inclusion criteria were the following: (1) the subject was aged 65 years or older; (2) the subjects was hospitalized for first close-type hip fracture (ICD-9-CM codes 820.00–820.09, 820.20–820.22, and 820.8); and (3) hip fracture was treated with HA (ICD-9-PCS code 81.52) or IF (ICD-9-PCS codes 78.55, 79.15, and 79.35). Subjects with unclear data (N = 21,987) or a diagnosis of pathological fracture (ICD-9-CM code 733.1x; N = 691) were excluded. A total of 153,623 subjects with hip fracture surgery were enrolled in the present study, of which 93,029 underwent IF surgery (IF group) and 60,594 cases received HA (HA group). We conducted a longitudinal follow-up on each subject for two years after discharge. Because the NHIRD contains only deidentified secondary data, obtaining informed consent from the enrolled subjects was unnecessary.

Definition of dementia and other variables

To determine the impact of dementia on postoperative mortality within two years, eligible subjects in both groups were further divided into subgroups of subjects with dementia and those without dementia. The ICD-9-CM codes of the primary discharge diagnosis used for dementia identification were 290.x (dementia), 294.1 (dementia as a symptom of a separate condition), and 331.0 (Alzheimer disease). To verify the diagnosis of dementia, only the dementia coded by neurologist prior to hospitalization was adopted. Other analysed demographic and clinical variables were sex, age, comorbidities, and hospital level. To identify differences based on age, the ages of the enrolled subjects were categorised as 65–74, 75–84, and ≥85 years. To quantify comorbidity severity, we calculated the Charlson comorbidity index (CCI) by using ICD-9-CM codes (Table 1) and protocols proposed by Quan et al. (Quan et al., 2005). Hospital level was classified as medical centre or non-medical centre.

2.3. Main outcome measures

The primary endpoint of the present study was postoperative mortality within two years. Mortality was defined as a subject withdrawing from the NHI program and not rejoining (Wu et al., 2012). Individuals are withdrawn from the NHI program for the following three reasons: (1) mortality; (2) being missing for more than six months; and (3) disqualification of alien residents because of an expired duration of stay. Cases of individuals being missing for more than 6 months are

Table 1
Diagnoses used to calculate Charlson comorbidity index.

Diagnosis	ICD-9-CM Code
Myocardial infarction	410.x, 412.x
Congestive heart failure	428.x
Peripheral vascular diseases	441.x, 443.9, 785.4, V43.4
Cerebrovascular diseases	430.x-438.x
Dementia	290.x, 294.1, 331.0
Chronic pulmonary disease	490.x-505.x, 506.4
Rheumatologic diseases	710.0, 710.1, 710.4, 714.0-714.2, 714.81, 725.x
Peptic ulcer diseases	531.x-534.x
Mild liver diseases	571.2, 571.4-571.6
Diabetes without chronic complications	250.0-250.3, 250.7
Diabetes with chronic complications	250.4-250.6
Hemiplegia or paraplegia	342.x, 344.1
Renal diseases	582.x, 583-583.7, 585.x, 586.x, 588.x
Any malignancy	140.x-172.x, 174.x.-195.8, 200.x-208.x
Moderate/severe liver diseases	456.0-456.21, 572.2-572.8
Metastatic solid tumor	196.x-199.1
Acquired Immune Deficiency Syndrome	042.x-044.x