Letter to the Editor

Epidemiological Characteristics of Non-Simultaneous Bilateral Fragility Hip Fractures in an Elderly Singaporean Population

Dear Editor,

Hip fractures are the leading fractures in the elderly and are associated with high morbidity and mortality.[1]

They are a growing public health concern due to the functional and social repercussions in the elderly. According to the International Osteoporosis Foundation, the incidence of hip fractures in Singapore in the years 2007 to 2009 was 331 per 100,000. With improving healthcare and an ageing population, this figure is projected to rise exponentially. An increase in the incidence of first hip fractures would imply an expected increase in second hip fractures.

Incidence rates of non-simultaneous bilateral fragility hip fractures in other countries range from 6% to 16%.[2-4] A first hip fracture is a major risk factor for sustaining a second one and the risk is highest during the initial year.[5] Other risk factors include age, osteoporosis, female, dementia, Parkinson's disease, etc. Moreover, second hip fractures are associated with a higher 1-year mortality rate of 31.6% compared to 27.3% after first fractures.[2]

Detailed characteristics of non-simultaneous bilateral fragility hip fractures in the elderly Singaporean population are limited. This study aimed to describe the patient and treatment characteristics of non-simultaneous bilateral hip fractures in a tertiary orthogeriatric hip fracture centre.

Materials and Methods

This was a single-centre retrospective study of consecutive patients aged 60 and above who were admitted to a tertiary orthogeriatric hip fracture centre for fragility hip fractures over a 1-year period (October 2011 to September 2012). Patient and data records were accurate as of time of data collection in 2015. Fragility hip fractures include intertrochanteric (IT) fracture and neck of femur (NOF) fracture.

Patients were identified from a hip fracture registry database that consisted of consecutive patients admitted to our institution. Presence of a previous contralateral hip fracture was confirmed with data in the patient files and assessment of radiographs. An example is seen in Figure 1. Pathological fractures other than osteoporotic were excluded. A flowchart of the selection process can be seen in Figure 2.

Demographic data and fracture characteristics were collected. Age-adjusted Charlson comorbidity index (AACI) was used to quantify the effects of comorbidities on the outcomes of patients. It has been validated as an effective predictor of health outcomes in hip fractures patients.[6]

A 4-point Likert scale (i.e. wheelchair-bound, walking with caregiver assistance, independent with walking aid and independent without walking aid) was used to grade the pre- and postoperative mobility level. Modified functional ambulation classification (MFAC) was used to assess functional outcomes at 6 months and 12 months. It was not available prior to occurrence of fracture. It has been validated in hip fracture patients.[7] Modified Barthel index (MBI) is a measure of physical disability relating to activities of daily living. Scoring was carried out on admission, prior to discharge and during outpatient visits.

Statistical analysis was carried out by IBM SPSS Statistics Version 22, with the assistance of a statistician. The traditional Wald confidence interval formula for proportions was used for calculating the 95% confidence interval around the cumulative incidence of non-simultaneous bilateral hip fractures. Descriptive statistics were used for the demographic variables. Spearman coefficient test was used to check for correlation between Charlson comorbidity index (CCI) and time between fractures. Wilcoxon signed rank test was performed on the data sets to identify any significant differences. All reported *P* values were 2-sided and values ≤ 0.05 were considered statistically significant.

Results

Demographics

Out of 538 patients in the database, the cumulative incidence of patients with non-simultaneous bilateral hip fractures was 7.25% (39). There were 32 (82.1%) females and 7 (17.9%) males. Also, 37 (94.9%) were of Chinese ethnicity and the remaining 2 (5.1%) were of Malay ethnicity. Mean age at first and second fracture occurrence was 77.0 years and 82.8 years, respectively. Mean time between first and second fracture was 70.3 months. AACI was 4.5 and 5.5 for the first and second fracture, respectively. There was moderate correlation between the increase in ACCI and shorter time between fractures (Spearman's rho = -0.355, *P* value = 0.039). A summary of the data can be found in Table 1.

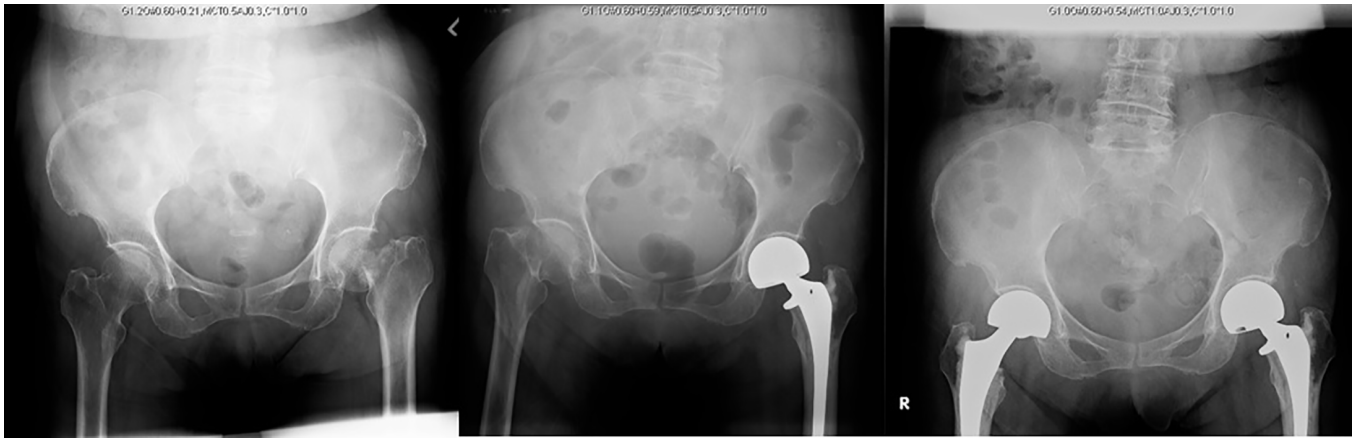

Fig. 1. Example of a patient with bilateral non-simultaneous hip fractures, radiographs at occurrence of first fracture (far left), second fracture (middle) and postoperative (far right).

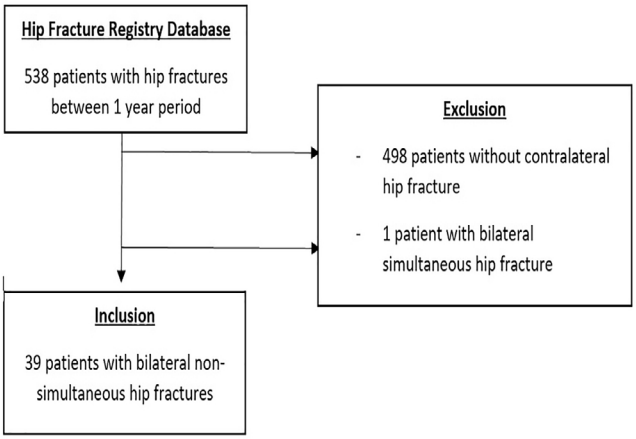

Fig. 2. Flowchart showing patient enrolment.

Fracture Characteristics

For the first fracture, there were 22 (56.4%) NOF fractures and 17 (43.6%) IT fractures. In addition, 36 (92.3%) patients underwent surgery for the first fracture and 3 (7.7%) were treated non-surgically.

For the second fracture, there were 17 (43.6%) NOF fractures and 22 (56.4%) IT fractures. Also, 31 (79.5%) patients underwent surgery for the second fracture and 8 (20.5%) were treated non-surgically.

Subgroup of Bilateral IT Versus Bilateral NOF Fractures

The majority (28 patients, 71.8%) of the first and second fractures were of similar morphology (15 IT and 13 NOF). No significant differences were noted in terms of functional outcomes (P = 1) and mortality (P = 0.686) between bilateral NOF and IT patients.

Anti-Osteoporosis Treatment

Prior to the second fracture, the majority (26 patients; 67.7%) were not on anti-osteoporosis treatment.

Functional Status

Eight out of 39 (20.5%) patients were able to regain their mobility status based on the 4-point Likert scale. Mean MFAC scores were 4.64 and 4.83 at 6 and 12 months, respectively. This increase of 0.19 was not statistically significant (P = 0.147). MBI scores prior to the second fracture was 87.2 and decreased to 57.0 on hospital discharge. The decrease of 30.2 was statistically significant (P <0.001).

Mortality

At time of data collection (mean, 3.1 years), overall mortality rate was 30.8% (12 patients; 10 females, 2 males).

Table 1. Demographics

	No. of Patients (n = 39)	
Gender	7 males (17.9%)	32 females (82.1%)
Ethnicity	Chinese: 37 (94.9%) Malay: 2 (5.1%)	
	Mean (Range)	**SD**
Age of occurrence of first fracture (years)	77.0 (60 – 96)	9.75
Age of occurrence of second fracture (years)	82.8 (65 – 98)	8.59
Time between first and second fracture (months)	70.3 (1 – 357)	65.76
Age-adjusted CCI at time of first fracture (n = 34)	4.5 (2 – 9)	1.64
Age-adjusted CCI at time of second fracture (n = 39)	5.5 (2 – 13)	2.09
Mortality (at Mean 3.1 Years)		
No. of patients	12 (10 females, 2 males)	
Mean age	85.3 years (72 – 96)	
Average time between second fracture and death	22.3 months (0 – 38)	

CCI: Charlson comorbidity index; SD: Standard deviation

Mean age was 85.3 years. One-year mortality was 7.7% (3 patients). The majority (6 patients; 50%) were deceased in the third year after the second fracture. Average time between second fracture and death was 22.3 months. Patients with lower MBI score on discharge had a higher mortality risk ($P = 0.025$). There is no statistical significant association between the time between first and second fractures and mortality ($P = 0.662$).

Discussion

This is the only study which investigates the incidence and characteristics of bilateral non-simultaneous fragility hip fractures in the local population. The cumulative incidence of 7.25% is comparable with data in the literature, ranging from 2% to 14.8%.[2,3,5,8] These figures are expected to rise exponentially with the ageing population. Our study confirms the clear female predominance in hip fracture patients. This may be explained by the increased life expectancy of women as well as the higher risk of osteoporosis in postmenopausal women, among other factors. In addition, the majority of our patients were of Chinese ethnicity, which correlates with the Chinese predominance in our multiracial population.

Mean time between the first and second fractures was 70.3 months, which is comparable to reported figures of 25 to 67 months.[3,5,8] One patient sustained a contralateral hip fracture after a fall in the ward during the same admission, which explains the wide variation in the range.

In this study, moderate correlation between the increase in AACI and shorter time between fractures was noted. This suggests that patients with more comorbidities at time of first fracture are likely to suffer from a second fracture at a shorter interval. This may be explained by the increased fall risk in patients with more comorbidities. In a study by Vu et al, more than 1 in 4 patients who had a fall, had at least 1 comorbid condition.[9]

More patients underwent surgery for the first fracture as compared to the second. This is not unexpected as the risks of surgery may outweigh the benefits as patients get more comorbidities when they age. A majority also had the same fracture morphology bilaterally. Many theories have been proposed but none have been proven. No differences were noted between patients with bilateral NOF and bilateral IT fractures in terms of functional outcomes and mortality. Limited evidence is present in the literature for comparison and this could be further studied.

Only a minority were able to regain their mobility status. Furthermore, there was limited improvement in their mobility postoperatively. This is consistent with data in the literature. Sawalha et al found that only 37.7% regained their mobility 1 year after surgery for a second hip fracture. Outcomes after second hip fractures were also not worse than that after first fractures. They hypothesised that the initial fracture group had better mobility scores prior and thus had more to lose.[2] On the other hand, Fukushima et al reported that significantly more patients had worse mobility after a second hip fracture.[10] Patients also suffered a decline in the independence of their activities of daily living. These highlight the functional repercussions of hip fractures and further emphasises the need for secondary prevention.

Hip fractures are responsible for an increase in mortality in the elderly population.[8,11] Our series had a 1-year mortality rate of 7.7% which is comparable to the mortality rate of 7.7% to 26% in the literature.[5,8,12,13] The majority was female, which is not unexpected given the female predominance. Many studies have showed that mortality rates are higher after second hip fractures.[5,12] Our study also noted that a lower MBI score (independence in ADLs) on discharge correlates with a higher mortality risk. This is not unexpected as a loss of autonomy is a predictive risk factor for death.[4,13] There was also no significant association between the time lapse between fractures and mortality (i.e. patients who suffered from hip fractures at shorter intervals did not have a higher mortality risk). However, this could be limited by the small sample size.

This study emphasises the vulnerability of the elderly population. There is undoubtedly a role for multidisciplinary approach for secondary prevention strategies. Prevention of falls and adequate rehabilitation are vital. Merle et al found that 80% of patients who had a hip fracture sustained a fall within the following year.[11] Also, in this series, the majority was not on anti-osteoporosis treatment. This may partly be due to the multiple comorbidities elderly patients already have, which precludes the use of antiresorptive therapies. Nonetheless, there is a clear need for better compliance to local guidelines for osteoporosis treatment. Several studies have shown promising results with an interdisciplinary geriatrician-led hip fracture service for patients.[14] Perhaps, a similar programme could be instituted for secondary prevention strategies.

The authors acknowledge several limitations to the present investigation. There is a relatively small sample size, which represents the uncommon occurrence of bilateral non-simultaneous hip fractures. We lack a control group with unilateral hip fractures. The strengths include the series of consecutive patients in a single institution with prospectively collected data and the use of validated scores and outcome measurements.

Conclusion

This is the first such study looking at non-simultaneous bilateral fragility hip fractures in the elderly Singapore population. There is a relatively high incidence rate of 7.25% and mortality rate. Patients with more comorbidities

at presentation of first fracture are likely to suffer a second fracture at a shorter interval. Sustaining a second hip fracture at a shorter interval did not result in a higher mortality risk. Moreover, there is a clear need for active treatment of osteoporosis and prevention of second fragility hip fractures.

REFERENCES

1. Bliuc D, Nguyen ND, Milch VE, Nguyen TV, Eisman JA, Center JR. Mortality risk associated with low-trauma osteoporotic fracture and subsequent fracture in men and women. JAMA 2009;301:513-21.
2. Sawalha S, Parker M. Characteristics and outcome in patients sustaining a second contralateral fracture of the hip. J Bone Joint Surg Br 2012;94:102-6.
3. Burgers PT, Zielinski SM, Mailuhu AK, Heetveld MJ, Verhofstad MH, Roukema GR, et al. Cumulative incidence and treatment of non-simultaneous bilateral femoral neck fractures in a cohort of one thousand two hundred and fifty patients. Int Orthop 2014;38:2335-42.
4. Gaumetou E, Zilber S, Hernigou P. Non-simultaneous bilateral hip fracture: epidemiologic study of 241 hip fractures. Orthop Traumatol Surg Res 2011;97:22-7.
5. Berry SD, Samelson EJ, Hannan MT, McLean RR, Lu M, Cupples LA, et al. Second hip fracture in older men and women: the Framingham Study. Arch Intern Med 2007;167:1971-6.
6. Neuhaus V, King J, Hageman MG, Ring DC. Charlson comorbidity indices and in-hospital deaths in patients with hip fractures. Clin Orthop Relat Res 2013;471:1712-9.
7. Chau MWR, Chan SP, Wong YW, Lau MYP. Reliability and validity of the Modified Functional Ambulation Classification in patients with hip fracture. Hong Kong Physiotherapy Journal 2013;31:41-4.
8. Gaumetou E, Zilber S, Hernigou P. Non-simultaneous bilateral hip fracture: epidemiologic study of 241 hip fractures. Orthop Traumatol Surg Res 2011;97:22-7.
9. Vu T, Finch CF, Day L. Patterns of comorbidity in community-dwelling older people hospitalised for fall-related injury: a cluster analysis. BMC Geriatr 2011;11:45.
10. Fukushima T, Sudo A, Uchida A. Bilateral hip fractures. J Orthop Sci 2006;11:435-8.
11. Merle V, Moret L, Josset V, Pidhorz L, Piétu G, Gouin F, et al. [Factors affecting quality of care for elderly subjects undergoing surgery for hip fracture: review of the literature]. Rev Chir Orthop Reparatrice Appar Mot 2004;90:504-16.
12. Lee SH, Chen IJ, Li YH, Fan Chiang CY, Chang CH, Hsieh PH. Incidence of second hip fractures and associated mortality in Taiwan: a nationwide population-based study of 95,484 patients during 2006-2010. Acta Orthop Traumatol Turc 2016;50:437-42.
13. Wong MK, Arjandas, Ching LK, Lim SL, Lo NN. Osteoporotic hip fractures in Singapore–costs and patient's outcome. Ann Acad Med Singapore 2002;31:3-7.
14. Doshi HK, Ramason R, Azellarasi J, Naidu G, Chan WL. Orthogeriatric model for hip fracture patients in Singapore: our early experience and initial outcomes. Arch Orthop Trauma Surg 2014;134:351-7.

Bing Howe Lee, [1]*MRCS (Eng)*, Ernest BK Kwek, [1]*MBBS, MMed(Ortho), FRCS(Edin)(Ortho)*

[1]Department of Orthopaedic Surgery, Tan Tock Seng Hospital, Singapore

Address for Correspondence: Adj A/Prof Ernest Kwek Beng Kee, Department of Orthopaedic Surgery, Tan Tock Seng Hospital, 11 Jalan Tan Tock Seng, Singapore 308433.
Email: ernest_kwek@ttsh.com.sg