Original Article

Older Chinese patients with fragility hip fracture in Hong Kong: calling for focused ortho-geriatric co-care

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Background: Orthogeriatric co-management is the standard of care of hip fracture.

Methods: This retrospective study aimed to evaluate the differences of clinical characteristics and outcomes of older patients (aged ≥50 years) hospitalised for hip fracture in six public hospitals in Hong Kong in 2012. They were categorized into three groups based on their need for peri-operative medical optimization: inputs from geriatricians (Group 1), inputs from general physicians (Group 2) and no need for medical inputs (Group 3). We compared their clinical characteristics, surgical treatment and short-term outcomes.

Results: In total, 2,748 patients were analyzed. Compared with patients of Group 3 (n=1,322), those of Group 1 (n=422) and 2 (n=1,004) were slightly older, less able to walk independently and more likely to have pressure ulcer on admission. They also had higher peri-operative risk (American Society of Anesthesiologist Grade ≥3) with a larger number of comorbidities. Group 3 had the largest proportion (72.7%) of patients who had early surgical treatment (<48 hours of admission), followed by Group 1 (59.5%) and Group 2 (48.1%). Patients of Group 3 had the lowest incidence of post-operative complications, in-hospital mortality, length of stay (LOS) in acute hospital and institutionalisation.

Conclusions: The demand for peri-operative medical optimization in older patients undergoing hip fracture surgery was very huge. We may re-engineer the existing service model in view of ageing population. Group 3 represented a distinct group of healthier patients who can be managed by a nurse-led approach.

Keywords: Hip fracture; orthogeriatric co-care; nurse-led model

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Introduction

Fragility hip fracture is an untoward event to an older adult because it is frequently linked to disability, high peri-operative risk, institutionalization and mortality. The co-care of hip fracture by orthopedic surgeons and geriatricians has been the focus of academic research and service development in recent two decades. The goals are to reduce time to surgery, encourage post-operative early mobilization, and minimize peri-operative complications and mortality. The year of 2007 marks the inauguration of orthogeriatric co-care model for older patients with hip fracture in the United Kingdom (UK). The British Orthopaedic Association and the British Geriatrics Society have co-published a 'Blue Book' on the standard of care of fragility fracture, including acute care and secondary prevention (1). The audit of collaborative work is delivered through the National Hip Fracture Database (NHFD).

In Hong Kong, the Hospital Authority (HA) is the major provider of public healthcare service, especially in-patient

care. There are 15 acute hospitals which provide emergency orthopedic service for almost all (98%) of hip fracture patients. The age-adjusted annual incidence of geriatric hip fracture (per 100,000 populations) was reported to decrease from 381.6 for men and 853.3 for women in 2001 to 341.7 for men and 703.1 for women in 2009 (2). However, the annual number of older patients undergoing hip fracture surgery increased significantly by one-third from 3,478 in 2000 to 4,579 in 2011 because of aging population. They aged from 65 to 112 years. The mean and median ages were 82.1 and 82.0 years respectively. The overall 30-day and 1-year mortality rates were 3.0% and 15.6% respectively (3). There was no significant change in the trends of post-trauma mortality (2). We believe that the reduction in the incident hip fracture is related to better bone health protection in Hong Kong, such as exercise, diet and anti-resorptive medications, in the recent decade.

In light of growing number of hip fracture patients, we conducted a retrospective study to evaluate the differences of clinical characteristics and outcomes of older patients hospitalized for hip fracture based on their needs for peri-operative medical optimization.

Methods

Fragility fracture registry (FFR)

In 2015, Department of Orthopaedics and Traumatology of the Chinese University of Hong Kong (CUHK) initiated a FFR by performing a retrospective analysis of all patients hospitalized for fragility hip fracture in 2012. There were six public hospitals located in different clusters of the HA, namely Caritas Medical Centre, Prince of Wales Hospital, Princess Margaret Hospital, Queen Elizabeth Hospital, Queen Mary Hospital and Tuen Mun Hospital (in alphabetical order) (4).

Study subjects were patients aged ≥50 years who sustained hip fracture after a fall from standing height. The cut-off of 50 years was chosen because fragility hip fracture occurred after this age, including post-menopausal women. Patients were excluded from analysis if they were treated conservatively or were admitted for pathological or atypical fractures. They were identified through the HA Clinical Data Analysis and Reporting System (CDARS) with disease codes of acute hip fracture (ICD-9-CM 820.X). We had obtained approval from the Clinical Research Ethics Committee of all the hospitals. Data on the acute, convalescence and post-discharge care were captured from the HA Clinical Management System, Electronic Patient Record System and written clinical notes. The liaison team of each hospital, which comprised orthopedic surgeons and nurses, randomly selected 20% of all study subjects for data validation. Each liaison member completed training from the central research team before commencement of the study (4).

This study was approved by the Clinical Research Ethics Committee of the participating hospitals and was conducted in accordance with the ethical standards laid in the Declaration of Helsinki (Reference: CRE-2012.259). It was supported by grant of Asian Association for Dynamic Osteosynthesis (Reference: AADO-RF2012-001-2Y) and Professional Services Development Assistance Scheme, HKSAR.

We analyzed patients who underwent surgical treatment of hip fractures. They were categorized into three groups based on their need for peri-operative medical optimization: inputs from geriatricians (Group 1), inputs from general physicians (Group 2) and no need for medical inputs (Group 3). It was the discretion of attending orthopaedic surgeons on initiating consultations to geriatricians or general physicians. We compared their clinical characteristics (age, gender, residential status, premorbid mobility status, presence of pressure ulcer on admission, comorbidity, premorbid cognitive status, details of hip fracture, concomitant non-hip fracture), surgical treatment [American Society of Anesthesiologists (ASA) grade, type of anesthesia, early surgery (<48 hours of admission), time to surgery and type of surgery] and short-term outcomes [post-operative complications, length of stay (LOS) in acute hospitals, institutionalization, in-hospital mortality and mobility status at the first follow-up after discharge from hospital]. Institutionalization was defined as the change in residential status of community-living patients to nursing home upon discharge from hospital.

Statistical analysis

Categorical and continuous variables were expressed in numbers (%) and means (± standard deviation) respectively. We compared patients of three groups by chi-square test for categorical variables and one-way ANOVA for continuous variables. We set α-error as 0.05. The Statistical Package for Social Sciences IBM 23.0 was used for statistical analysis.

Results

There were 2,914 patients in the FFR. We excluded 166

patients because conservative approach was adopted in 141 patients and clinical notes were missing in 25 patients. Of the remaining 2,748 patients who underwent surgery for hip fracture, the mean age was 82.0 (±8.6) years and a quarter (25.0%) resided in nursing homes. Almost all of them (98.1%) were aged 60 or above. There was a preponderance of female patients, i.e., 68.5%. Over half (51.9%) of them required peri-operative medical optimization, i.e., Group 1 and Group 2. There were 422, 1,004 and 1,322 patients in Group 1, 2 and 3 respectively.

The baseline clinical characteristics of study patients are shown in *Table 1*. Compared with patients of Group 3, those of Group 1 and 2 were slightly older, less able to walk independently and more likely to have pressure ulcer. They also had higher peri-operative risk (ASA grade) and a greater burden of comorbidity, including chronic renal impairment, respiratory diseases, gastrointestinal diseases and hypertension. Patients of Group 2 were more likely to have chronic cerebrovascular accident and heart diseases. There was no difference in cognitive status among three groups of patients.

Table 2 summarizes the details of hip fracture and surgery. With the exception of one, all the patients suffered from unilateral hip fracture. Compared with patients of Group 1, those of Group 2 and 3 were more likely to suffer from trochanteric and sub-trochanteric fractures with surgery performed under spinal anesthesia. Group 3 had the largest proportion (72.7%) of patients who could have surgery done within 48 hours of admission, followed by Group 1 (59.5%) and Group 2 (48.1%).

Table 3 indicates that clinical outcomes, in terms of post-operative complications (deep vein thrombosis, delirium and retention of urine), in-hospital mortality, LOS in acute hospital and institutionalization, were the best in patients of Group 3. Patients of Group 1 had a lower risk of institutionalization than those of Group 2, and had a lower risk of decline in mobility than those of Group 2 and 3, although the differences did not reach statistical significance. Delirium was significantly much more common in patients of Group 1 than those of Group 2 and 3.

Discussion

Our report confirms that there is a huge demand for peri-operative medical optimization in older patients undergoing hip fracture surgery, and orthogeriatric co-care is superior to conventional care by general physicians in improving time to surgery and in-hospital mortality.

The large sample size is the strength of this study. To the best of our knowledge, this study is the one which enrolls the largest number of patients to evaluate the clinical effectiveness of orthogeriatric co-care of hip fracture. The HA CDARS showed that 5,025 patients aged ≥50 years underwent hip fracture surgery in 15 public hospitals in 2012. Our study analyzed the clinical profiles and trajectory of over half (55%) of these patients. Thus, this CUHK FFR 2012 report is an important documentary for future studies on geriatric hip fracture in Hong Kong.

There are three models of orthogeriatric co-care of hip fracture: orthopedic ward with geriatric consultative service, geriatric ward with orthopedic consultative service and orthogeriatric ward with shared ownership (5-7). The first model has the longest history of development. It is the hospital policy, availability of resources and demand for service that determine the model of co-care. Different centers of a country may adopt different models. In Hong Kong, orthogeriatric co-care of hip fracture is a budding service in the HA (8). A tertiary center has commenced proactive geriatric consultative service for hip fracture patients in the orthopedic wards since 2005, i.e., the first model aforementioned (9,10). Currently, an increasing number of hospitals are in provision of orthogeriatric co-care of hip fracture. Patients of Group 3 are a distinct group of robust older adults who have better mobility and less comorbidity. They do not need peri-operative medical inputs. Nonetheless, their clinical outcomes are the best when compared with other patients. These enlightening results shed light on reengineering orthogeriatric co-care service of hip fracture in our locality when we have a rapidly rising number of older patients with hip fracture and shortage of geriatricians. A nurse-led and protocol-driven approach is an option. The nurses, who are experienced in geriatrics and orthopedic surgery, can assess all of the geriatric patients with hip fracture and identify those who are in need of peri-operative medical inputs. Patients with simple medical problems, such as urine retention, constipation, mild delirium, mild sepsis, glycemic control, blood pressure control, bridging heparin therapy and initiation of bone protective medications, can be safely managed with protocols co-designed by orthopedic surgeons and geriatricians. The nurses can resort to geriatricians for patients with complex medical problems, such as chest pain, arrhythmia, hypoxemia, uncontrolled delirium, severe sepsis, acute renal failure, acute cerebrovascular accident, unexplained anemia and thromboembolism. In the face of growing demand for orthogeriatric co-care, this nurse-

Table 1 Clinical characteristics of study patients

Clinical characteristics	Group 1 (n=422)	P value	Group 2 (n=1,004)	P value	Group 3 (n=1,322)
Age (years)	83.1 (±7.8)	0.003	82.3 (±8.4)	0.052	81.5 (±8.9)
Gender (female)	277/422 (65.6%)	0.051	670/1,004 (66.7%)	0.056	934/1,322 (70.7%)
Community living	77.7% (327/421)	0.124	74.8% (745/996)	0.660	74.0% (973/1,315)
Premorbid mobility status					
Walk independently	32.6% (136/417)	0.002*	30.9% (309/1,000)		39.3% (519/1,319)
Walk with 1 aid	40.8% (170/417)		41.3% (413/1,000)		36.5% (481/1,319)
Walk with 2 aids/frame	6.2% (26/417)		8.0% (80/1,000)		6.6% (87/1,319)
Homebound to bedbound	20.4% (85/417)		19.8% (198/1,000)		17.6% (232/1,319)
Pressure ulcer	15/408 (3.7%)	<0.001	21/995 (2.1%)	0.032	13/1322 (1.0%)
Good past health	2.4% (10/422)	0.028	1.9% (19/1004)	<0.001	4.9% (65/1,322)
History of fragility fracture	130/422 (30.8%)	0.890	297/1004 (29.6%)	0.434	411/1322 (31.1%)
Comorbidity					
Arthritis	23.2% (98/422)	0.048	20.5% (206/1,004)	0.289	18.8% (248/1,322)
Cerebrovascular accident	23.0% (97/422)	0.467	25.6% (257/1,004)	0.014	21.3% (281/1,322)
Dementia	21.3% (90/422)	0.391	16.4% (165/1,004)	0.069	19.4% (256/1,322)
Diabetes mellitus	28.4% (120/422)	0.093	34.6% (347/1,004)	<0.001	24.3% (321/1,322)
Gastrointestinal diseases	32.7% (138/422)	0.002	29.8% (299/1,004)	0.015	25.3% (334/1,322)
Heart diseases	26.5% (112/422)	0.363	39.7% (399/1,004)	<0.001	24.3% (321/1,322)
Hypertension	69.2% (292/422)	0.001	68.6% (689/1,004)	<0.001	60.2% (796/1,322)
Osteoporosis	3.3% (14/422)	0.111	4.0% (40/1,004)	0.164	5.2% (69/1,322)
Parkinson's disease	4.5% (19/422)	0.664	3.9% (39/1,004)	0.879	4.0% (53/1,322)
Chronic renal impairment	13.0% (55/422)	0.023	17.9% (180/1,004)	<0.001	9.2% (121/1,322)
Respiratory diseases	19.4% (82/422)	<0.001	19.5% (196/1,004)	<0.001	10.3% (136/1,322)
Visual impairment	30.6% (129/422)	0.923	34.2% (343/1,004)	0.060	30.5% (403/1,322)
Sum of comorbidity	3.0 (±1.7)	<0.001	3.2 (±1.7)	<0.001	2.5 (±1.7)
Pre-operative MMSE score	16.1 (±6.4)	0.756	15.5 (±7.1)	0.850	15.6 (±6.9)
ASA grade					
1–2	36.8% (151/410)	<0.001	33.0% (331/1,002)	<0.001	52.4% (690/1,318)
3–5	63.2% (259/410)		67.0% (671/1,002)		47.6% (628/1,318)

*, the overall P value for comparison among three groups. Group 1, inputs from geriatricians; Group 2, inputs from general physicians; Group 3, no need from peri-operative medical inputs (reference). MMSE, mini-mental state examination; ASA, American Society of Anesthesiology.

led liaison approach facilitates the efficient mobilization of manpower and replaces a formal orthogeriatric unit (11).

Our study concurred with previous works that when compared with conventional care by general physicians, orthogeriatric co-care of hip fracture achieved clinical effectiveness by decreasing time to surgery (12-15), and lowering in-hospital mortality (16-19). Similarly, orthogeriatric co-care reduced institutionalization of

Table 2 Details of hip fracture and surgery

Hip fracture and surgery	Group 1 (n=422)	Group 2 (n=1,004)	P value	Group 3 (n=1,322)	P value
Type of hip fracture					
Neck of femur	51.7% (218/422)	41.9% (421/1,004)		45.4% (600/1,322)	0.003*
Trochanteric	46.4% (196/422)	53.1% (533/1,004)		50.9% (673/1,322)	
Sub-trochanteric	1.9% (8/422)	5.0% (50/1,004)		3.7% (49/1,322)	
Side of hip fracture (left)	49.5% (209/422)	529/1,004 (52.7%)	0.275	712/1,322 (53.9%)	0.121
Concomitant non-hip fracture	2.8% (12/422)	48/1,004 (4.8%)	0.100	59/1,322 (4.5%)	0.146
Type of anesthesia					
Spinal anesthesia	309/422 (73.2%)	789/1,003 (78.7%)	0.026	1,101/1,322 (83.3%)	<0.001
General anesthesia	113/422 (26.8%)	214/1,003 (21.3%)		221/1,322 (16.7%)	
Early surgery[†]	59.5% (245/412)	48.1% (478/993)	<0.001	72.7% (940/1,293)	<0.001
Time to surgery (hours)	71.6 (±89.1)	85.6 (±103.4)	0.006	42.3 (±32.5)	<0.001
Type of surgery					
Hip screw	20.4% (86/422)	25.2% (253/1,004)		34.2% (452/1,322)	<0.001*
Intramedullary nail	38.4% (162/422)	38.7% (389/1,004)		31.8% (421/1,322)	
Arthroplasty	41.2% (174/422)	36.1% (362/1,004)		34.0% (449/1,322)	

*, the overall P value for comparison among three groups; [†], surgery performed within 48 hours of admission. Group 1, inputs from geriatricians (reference); Group 2, inputs from general physicians; Group 3, no need for peri-operative medical inputs.

community-dwelling older patients from 25.4% to 20.2%, although the difference was not statistically significant. Nonetheless, the magnitude of reduction is clinically important in view of a large number of incident cases of hip fracture each year, and a bigger sample size would definitely produce a statistically significant result. In contrast to previous studies, our work failed to demonstrate that orthogeriatric co-care could improve functional recovery (17,20-25), and reduce LOS in hospital (12-15,22). Few studies even indicated that LOS in hospital was longer in patients receiving orthogeriatric co-care compared with those under conventional care (19,21). One should note that LOS in hospital is multi-factorial with social factors, such as availability of caregivers, frequently playing a significant role. Thus, LOS in hospital should not be solely relied on for evaluation of the clinical effectiveness of a clinical programme.

There were few randomized controlled trials on the effect of orthogeriatric co-care on delirium. An early study showed that it reduced the incidence of delirium by over one-third, and severe delirium by over one-half (26). The recent two studies showed less favorable results. One study suggested that the incidence of delirium was reduced by 16% but its severity or duration remained unchanged (27). The other one showed neutral results (23). In contrast, delirium was reported much more frequently in our patients cared by geriatricians than other patients because of confounding bias. First, delirium is one of the most common reasons for peri-operative consultation on geriatricians. Second, delirium is always the focus of geriatric care. It is very likely that geriatricians make the diagnosis of delirium more frequently than general physicians and orthopedic surgeons. Thus, the impact of orthogeriatric co-care on delirium should be evaluated prospectively in the future.

Our study has several limitations. First, it was retrospective in nature so much so that we could not estimate the incidence of delirium in three groups of patients and accounted for a higher prevalence of delirium in patients under orthogeriatric co-care than other patients. Comorbidity was simply represented by the total number of diseases without taking account of the severity of individual diseases, such as Groll's Functional Comorbidity Index (28). Similarly, we did not record the use of medications, especially anti-coagulants. We did not capture the reasons for late surgery and conservative treatment, and the differences in the inputs between geriatricians and general

Table 3 Clinical outcomes of study patients

Clinical outcomes	Group 1 (n=422)	Group 2 (n=1,004)	P value	Group 3 (n=1,322)	P value
Post-op complications					
Deep vein thrombosis	5/422 (1.2%)	12/1,004 (1.2%)	0.314	1/1,322 (0.08%)	<0.001
Delirium	66/422 (15.6%)	39/1,004 (3.9%)	<0.001	5/1,322 (0.4%)	<0.001
Pressure ulcer	20/422 (4.7%)	75/1,004 (7.5%)	0.061	57/1,322 (4.3%)	0.710
Retention of urine	120/422 (28.4%)	318/1,004 (31.7%)	0.227	235/1,322 (17.8%)	<0.001
Wound infection	12/422 (3.3%)	41/1,004 (4.1%)	0.261	28/1,322 (2.1%)	0.388
Mortality in acute hospital	1.9% (8/422)	4.1% (41/1004)	0.043	0.2% (3/1,332)	0.002
Overall mortality[†]	3.8% (16/422)	6.7% (67/1004)	0.036	1.1% (14/1,322)	<0.001
LOS in acute ward (days)	14.5 (±14.0)	15.4 (±12.0)	0.285	8.6 (±5.3)	<0.001
Institutionalization[‡]	20.2% (66/327)	25.4% (189/745)	0.067	19.1% (186/973)	0.673
Mobility status[§]					
Walk independently	2.3% (7/301)	1.9% (13/673)		3.6% (36/1,013)	0.028*
Walk with 1 aid	18.3% (55/301)	16.9% (114/673)		21.2% (215/1,013)	
Walk with 2 aids/frame	13.6% (41/301)	11.9% (80/673)		14.2% (144/1,013)	
Homebound to bedbound	65.8% (198/301)	69.2% (466/673)		61.0% (618/1,013)	
Decline in mobility (§)	69.9% (209/299)	71.3% (478/670)	0.648	73.9% (748/1,012)	0.170

*, the overall P value for comparison among three groups; [†], mortality in both acute and convalescence hospitals; [‡], the denominator is the number of patients living in the community prior to admission; [§], as at the first follow-up after discharge from hospital. Group 1, inputs from geriatricians (reference); Group 2, inputs from general physicians; Group 3, no need for peri-operative medical inputs. LOS, length of stay.

physicians. The information on the duration of surgery was also lacking.

Conclusions

There is a huge demand for orthogeriatric co-care of hip fracture patients. A nurse-led and protocol-driven approach is a possible option when a limited number of geriatricians are serving an increasing population of hip fracture patients.

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Footnote

Conflicts of Interest: The author has completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/jhmhp.2019.06.06). The author has no conflicts of interest to declare.

Ethical Statement: The author is accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was approved by the Clinical Research Ethics Committee of the participating hospitals and was conducted in accordance with the ethical standards laid in the Declaration of Helsinki (as revised in 2013) (Reference: CRE-2012.259).

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