Economic cost of osteoporotic hip fractures in Singapore

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ABSTRACT

Introduction: The incidence of osteoporotic hip fractures in Singapore as well as in Asia will gradually increase with an ever ageing population. The objectives of this study were to understand the costs of hip fractures in our community and to analyse the various factors that lead to higher inpatient costs for hip fractures.

Methods: We prospectively reviewed 80 elderly patients with osteoporotic hip fractures. The relevant patients' clinical data was correlated with the inpatient hospitalisation costs. We reviewed the cost and management practices of hip fractures published in the literature and compared them with our findings.

Results: We found that our patients treated surgically incurred lower costs and had a shorter inpatient stay compared to those treated conservatively. The mean hospitalisation cost for patients treated surgically was S$10,515 and the mean length of stay was 16 days. We found that the length of stay, a longer delay to surgery, male gender, having ASA 3 score, and development of postoperative complications led to higher inpatient hospital costs.

Conclusion: With the identification of various clinical factors that are associated with high inpatient costs, we can further shorten our hip fracture patients' stay as well as reduce the hospitalisation costs.

Keywords: cost-effective treatment, economic cost, hip fractures, hospitalisation costs, osteoporotic hip fractures, proximal femoral fractures

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INTRODUCTION

It is predicted that the incidence of hip fractures will increase rapidly, especially in Asia where the growth of the elderly population is more marked. Patients with osteoporotic hip fractures require a prolonged hospital stay for surgery and rehabilitation. These fractures represent a significant proportion of an orthopaedic department's workload and impose a high economic burden to society. These costs are likely to increase with rising healthcare costs in the face of growing numbers of hip fractures. It is necessary for us to periodically assess the outcomes and costs of these fractures and determine if any improvements can be made to shorten the patients' duration of stay, reduce inpatient costs, and improve outcomes.

There were various studies in the literature that reviewed the costs of hip fractures, with the majority being conducted in Europe and North America. There was one other study published in Asia that looked at the costs and outcome of hip fracture patients in the 1990s. Since then, there has been no other review to study the costs of such fractures in Singapore and Asia. We undertook this review to understand the inpatient costs in managing elderly hip fractures and to develop cost containment strategies to deal with this evolving condition in our ageing population.

METHODS

Between May 2001 and September 2001, 80 consecutive patients with hip fractures, aged 60 years and older, and admitted to our hospital with proximal femur fractures, were prospectively enrolled. Patients with a pathological fracture secondary to metastasis were excluded. There were 11 non-subsidised patients in our study cohort. In our medical system, the patients and their family choose the type of ward and the level of government subsidy. By choosing a private ward or unsubsidised ward, they would incur higher daily ward charges as well as higher charges for investigations and treatments. These 11 patients were excluded from our cost analysis as the ward and treatment charges were different from the majority of our subsidised cases and would affect our cost analysis. The remaining 69 subsidised patients were studied.

Clinical data, such as age, gender, comorbidity, American Society of Anaesthesiologists (ASA) classification, fracture type, method of fracture

Table I. Breakdown of bill sizes.

Itemisation of the bill charges	Average percentage
Ward charges	34.4
Investigations	11.5
Treatment/medication	18.2
Implant	4.8
Surgical/anaesthetic/OT charges	31.1

management, time to surgery, length of stay, occurrence of complications and discharge locations, was collected. The ASA classification is as follows – 1: normal healthy; 2: mild systemic illness; 3: severe illness; 4: severe incapacitating systemic illness, constant threat to life; 5: moribund patient. In our cohort, based on their age and pre-existing comorbidities, all our patients was classified either as ASA 2 or ASA 3. The costs of the inpatient hospital stay before government subsidy were obtained from the hospital business office. This information, which was obtained from the actual bills that were sent to patients, was tabulated and analysed. The percentage breakdown of the various components of the inpatient hospital: ward charges, investigations, treatment, implant costs, surgical and operating room fees are shown in Table I.

Statistical analysis was carried out with the Statistical Package for Social Sciences version 11.0 (SPSS Inc, Chicago, IL, USA). The Spearman correlation coefficient was used to compare the relationship between the length of hospital stay, delay to surgery, age and inpatient hospitalisation costs. For comparison of the various factors that affect inpatients' length of stay and hospital costs, the non-parametric tests of significance, Mann-Whitney and Kruskral-Wallis tests, were used.

RESULTS

Seven patients were treated non-surgically with traction. These patients either did not agree to surgery or were deemed high-risk because of multiple comorbidities. The median age of these patients was 81 (range 73–92) years. They were admitted for a mean length of stay of 20 days, with a range of 11–60 days, and a median cost of S$16,043 (range S$10,233–S$29,705).

The remaining 62 subsidised patients were treated surgically. The median age of these patients was 79.5 (range 60–98) years. The median cost for the hospital admission was S$10,515 (range S$6,359–S$50,603). The median length of stay for our study cohort was 16 days, with a range of 7–38 days. We found that the patients' length of stay had a significant positive correlation (Spearman correlation coefficient 0.918) to the hospitalisation charge, i.e. the longer the length of stay, the higher the inpatient costs incurred. We saw that for the majority of our patients, the surgical, anaesthetic and operating room fees were fairly constant.

The median length of delay to surgery was 2.5 days, with a range of 1–13 days. We found a statistically significant positive Spearman correlation coefficient 0.40 ($p = 0.010$) between a longer delay to surgery and the length of hospital stay as well as a positive Spearman correlation coefficient 0.378 ($p = 0.03$) between a longer delay to surgery and higher inpatient costs. Table II shows the costs of hospitalisation against various factors like gender, fracture type, type of surgery, ASA levels, complications and discharge location.

We also found that male patients had a longer length of stay of 19 (range 9–38) days, and a higher median hospitalisation cost of S$13,748 (range S$8,477–S$50,603). This difference in inpatient costs and length of stay between the genders was found to be statistically significant ($p = 0.016$ and $p = 0.012$, respectively). We cross-tabulated gender against the number of comorbidities (< 2 comorbidities and ≥ 2 comorbidities). 70% of our male cohort had ≥ 2 comorbidities, as compared to 50% of our female cohort. However, this difference was not found to be statistically significant ($p = 0.11$) using the χ^2 tests.

We found that ASA grading and whether patients developed complications in the hospital were useful in predicting inpatient hospitalisation costs. We found that grade ASA 3 patients had a longer median length of stay of 20 (range 9–37) days, and a higher median hospitalisation cost of S$11,736 (range S$8,477–S$50,603). The patients that developed postoperative complications had a median length of stay of 24 (range 9–37) days, and a mean inpatient hospitalisation cost of S$11,905 (range S$8,477–S$50,603). The breakdown of complications were: urinary tract infections (three patients), deep vein thrombosis (two patients), pneumonia (one patient), gastrointestinal bleeding (one patient), and postoperative illeus (one patient). These differences for the two factors, ASA grading and whether patients developed complications in the hospital, were statistically significant for both length of stay and hospitalisation costs.

The locations to which our patients were discharged are shown in Table II. Those that were discharged home incurred the lowest costs and shortest stay. Using the non-parametric test of significance between the groups, the mean hospitalisation cost was statistically significant ($p = 0.045$), and the mean length of stay was very near significance ($p = 0.061$). Thus, we found that the longer the patient's stay in the hospital, the higher

Table II. Costs of hospitalisation against various determining factors.

Factors	No. (%) of patients	Median (range) cost of hospital stay (S$)	p-value	Median (range) duration of stay (days)	p-value
Fracture type			0.754		0.493
Neck of femur	26 (41.9)	11,162 (6,359–50,603)		19.0 (7–35)	
Intertrochanteric	36 (58.1)	10,106 (6,735–19,562)		15.0 (7–38)	
Type of surgical management			0.787		0.844
Dynamic hip screw	40 (64.5)	10,345 (6,775–19,562)		15.5 (7–38)	
Cancellous screw	5 (8.1)	11,233 (6,359–12,384)		19.0 (7–20)	
Hemiarthroplasty	17 (27.4)	10,197 (7,458–50,603)		18.0 (9–35)	
Gender			0.016		0.012
Male	20 (32.3)	13,748 (8,477–50,603)		19.0 (9–38)	
Female	42 (67.7)	10,234 (6,359–19,562)		15.0 (7–37)	
ASA status			0.010		0.046
ASA 2	43 (69.4)	9,724 (6,359–19,562)		15.0 (7–38)	
ASA 3	19 (30.6)	11,736 (8,477–50,603)		20.0 (9–37)	
During admission			0.027		0.022
No complications	53 (85.5)	10,011 (6,359–19,562)		15.0 (7–38)	
Complications	9 (14.5)	11,905 (8,477–50,603)		24.0 (9–37)	
Discharge location			0.045		0.061
Own home	22 (35.5)	9,907 (6,775–13,987)		13.5 (7–32)	
Nursing home	11 (17.7)	9,521 (8,478–13,464)		18.0 (9–26)	
Community hospital	25 (40.3)	11,368 (6,359–19,582)		19.0 (7–38)	
Passed away	4 (6.5)	14,180 (10,201–50,603)		30.0 (14–35)	

the costs of inpatient treatment for the hip fracture. The following factors were found to be significant ($p < 0.05$) in predicting higher inpatient hospitalisation costs incurred: (1) male gender, (2) ASA score, (3) longer delay to surgery, (4) presence of postoperative complications, and (5) discharge location.

DISCUSSION

There have been previously-published reviews on the cost of hip fractures in various countries. These show the epidemiology of elderly hip fracture patients and the practices in these countries with regard to inpatient costs of hip surgery. These reviews help us to compare the economic costs of hip fractures in the different countries (Table III).

Our epidemiological findings are similar to many of these previous studies. The mean age of 79 years and the significantly higher proportion of females (70%) compared similarly to these reviews. For a hip fracture managed in the UK in 2005, the mean duration of hospital stay was 23 days.[1] Our mean length of stay of 16 days is shorter than most other studies published. After currency conversion and taking into account cost inflation with time, our average acute hospital cost of S$10,515 is lower than most of these published figures. We can attribute this to the lower costs of medical care in our country as well as the shorter hospital stay for our hip fracture patients. A previous review by Wong et al on the cost and outcome of osteoporotic hip fractures in Singapore during the period 1991–1993 showed that the average inpatient costs were lower. However, this group of patients was reviewed ten years before our cohort and the higher costs of almost 25% can be attributed to inflation.[2] This is not unlike Reginster et al's findings of a 30% increase in direct costs of hip fracture treatment when comparing a cohort studied in 1996 with another that was studied in 1988.[3]

Many of these papers tried to correlate costs with various clinical factors that determine the inpatient stay. Kannus et al found that trochanteric fractures were more costly to treat than femur neck fractures due to the longer

Table III. Literature review on costs of hip fractures.

Publication	Country	Year of study	No. of patients	Age (years)	Length of stay (days)	Costs (USD)#
Sernbo and Johnell[9]	Sweden	1982–1985	1,429	71 M 78 F	24 M 30 F	6,000
Wong et al[2]	Singapore	1991	280	80.3	17	4,599 (SGD 7,267)
Zethraeus et al[10]	Sweden	1992	1,709	80	11	7,026
Wiktorowicz et al[11]	Canada	1995–1996	541	75.7 M 81.5 F	21	8,395 (CAD 9,820)
Reginster et al[3]	Belgium	1996	2,374	75.1	26	8,977
Autier et al[12]	Belgium	1995–1996	170	81	29	11,459 (GBP 8,667)
Haentjens et al[13]	Belgium	2000	159	78.7	29	9,534
Lawrence et al[1]	UK	2003	100	83	23	23,878 (EUR 12,163)
Lee et al*	Singapore	2001	80	79	16	5,783 (SGD 10,515)

* Current study
\# Conversion to US dollars at 2001 exchange rates
M: male; F: female

duration of stay[4] However, Scheerlinck et al found that the mean inpatient duration for hip fractures was poorly correlated with the type of surgery or with the place to which the patients were discharged.[5] We found that the cost incurred by our cohort of patients were not significantly related to their fracture type or surgery type. Chamberlin et al in 1997 found that only the duration of hospital stay had an influence on cost, while other factors like age, comorbidities and ASA scores did not have any statistical significant influence.[6] de Roguin et al also found that cost depended mainly on the length of hospital stay. They concluded that the way to lower the cost of hip fracture treatment was to reduce the length of stay in the hospital.[7] Our study concurred with these findings, where there was a significant correlation coefficient between the length of stay and inpatient costs.

Wong et al and Shabat et al found that operative delay to surgery for hip fractures led to high economic costs.[2,8] We also found that a longer delay to surgery meant higher costs. Thus, orthopaedic departments should endeavour to shorten the waiting time of hip fractures patients to surgery. Wong et al found that the cost was significantly related to preoperative sepsis, operative complications and cerebrovascular accidents.[2] In our study, we found that male patients, patients with higher ASA scores (3 and above), patients that developed postoperative complications and those that were discharged to a step-down facility or nursing home, incurred higher charges.

We found that our male patients have more comorbid conditions, although this did not reach statistical significance. The male patients therefore required a longer preoperative optimisation period in hospital and had more investigations performed, leading to higher inpatient hospital costs. For our patients with postoperative complications, they required a longer duration of stay in the hospital postoperatively as well as incurred more investigations and treatment costs. In our local setting, there is a waiting period for a hip fracture patients to be transferred to a step-down facility, such as a community hospital or nursing home, for rehabilitation. Unlike those patients who were discharged home, the waiting time for placement can account for the higher costs incurred for patients discharged to a community hospital or nursing home. Thus, a tangible area where the patients' length of stay as well as costs can be reduced is to have better placement and communication between acute and community hospitals.

Our findings have helped to provide the evidence for formulating pathways and developing strategies to rehabilitate our hip fracture patients and reduce their inpatient stay. In our institution, our osteoporotic hip fracture patients are co-managed preoperatively with a team of geriatricians and anaesthesiologists to shorten patient delay to surgery. Postoperatively, a multidisciplinary approach is adopted, where the orthopaedic surgeons, geriatricians, therapists and social workers work to optimise postoperative patient care, with the aim to reduce complications, accelerate mobilisation and proactively determine step-down care placement. Our hip fracture patients are placed on hip fracture pathways to standardise their management and care. This is done to reduce the length of stay and the related cost of inpatient stay. In this age of health resource optimisation, this would ensure that healthcare facilities are efficiently ultilised and allow more resources to be spent on post-discharge hip fracture rehabilitation for the patients.

We understand the limitations of our small sample size in this study. However, we feel that the findings are still relevant as they highlight the various factors that affect the length of hospital stay and inpatient hospital costs in hip fracture patients. Our plan is to use the study findings as a platform to compare the current with the subsequent hip fracture cohorts as we find ways to improve patient care, shorten acute hospital stays and reduce costs. We have found that our multidisciplinary approach to management of osteoporotic hip fractures has enabled us to keep our inpatient duration and costs relatively low. In addition, with the identification of various clinical factors associated with high inpatient costs, viz. higher ASA scores, male gender, development of postoperative complications and discharge location, we can further shorten our hip fracture patients' stay as well as reduce the hospitalisation costs.

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