

Osteoporotic Hip Fractures in Singapore—Costs and Patient's Outcome

M K Wong,^{*MD}, Arjandas,^{**MD}, L K Ching,^{***BSc}, S L Lim,^{****MD}, N N Lo,^{†MD}

Abstract

Introduction: Little data are available on costs and outcome associated with osteoporotic hip fractures in Singapore. **Materials and Methods:** A retrospective study was carried out on 280 consecutive hip fractures in patients older than 60 years admitted over a 3-year period. **Results:** The mean age of patients was 80 years. Sixty-eight per cent were female and 58% were intertrochanteric fractures. Two hundred and sixty-four patients (95%) were operated upon. The mean total hospitalisation period was 17 days. Seventy-six per cent were staying in their own homes prior to the hip fracture while 22% were admitted from nursing homes. After surgery, 63% of patients returned to their homes while 26% needed nursing home care. The index admission mortality rate was 5.7%. Mortality was 26% at 1 year. Of those alive at 1 year, ambulatory status was: 28% were walking without aids, 39% were walking with aids, 24% were wheelchair bound and 9% were bedridden. Poor ambulatory function at discharge was related to increased mortality at 1 year. The average cost incurred was S\$7367. The average government subsidy amounted to 82%. Ninety-one per cent of patients were warded in subsidised beds. Breakdown of cost was as follows: hospital stay, 42.6%; surgery, 36.5%; ward treatment, fee 9%; laboratory and X-ray investigations, 4.4%; implant costs, 3.5%; drugs, 1.6% and rehabilitation, 1.1%. Multivariate analysis showed that the cost is significantly related to days spent awaiting surgery, preoperative sepsis, operative complications and cerebrovascular accidents. Young age, good American Society of Anesthetists (ASA) status and endoprosthesis replacement were factors that allowed for early ambulation and lower costs. **Conclusion:** The mortality rates and functional outcome are not very different from published studies in the West. More of our patients returned to their own homes after hospitalisation. Early surgery, close involvement of the medical social worker and intensive physiotherapy or provision of outpatient therapy facilities may help cut cost of treatment.

Ann Acad Med Singapore 2002; 31:3-7

Key words: Ambulation, Function, Mortality, Morbidity, Osteoporosis

Introduction

Singapore is facing a rapidly ageing population. Osteoporosis, which is an age-related illness, will become an increasing problem. Osteoporotic hip fracture, because of the need for hospitalisation and surgery, represents an important economic burden to society, in addition to its medical morbidities and social implications upon the patient and the patient's family. This problem is well recognised and extensively studied in the West. Less has been written about hip fractures in our region. Two local studies^{1,2} reported significant morbidity after hip fractures in the elderly. Another paper³ reported that hip fracture rates in Singapore have risen rapidly over the past 30 to 40 years,

particularly in women, and are now among the highest in Asia. This study looks at the cost as well as outcome of treatment of hip fractures among the elderly in Singapore. In particular, we examine the profile of patients with hip fractures and look at predictive statistical models for costs of treatment, mortality and post fracture ambulatory status in order to identify factors that lead to poor outcome.

Materials and Methods

The medical records of all patients, 60 years of age or older, admitted to Alexandra Hospital for hip fractures over a 3-year period (1 January 1991 to 31 December 1993) were reviewed. Detailed billing information were retrieved.

* Consultant

** Senior Registrar

† Senior Consultant

Department of Orthopaedic Surgery
Singapore General Hospital

*** Finance Officer

Alexandra Hospital

**** Senior Consultant

Department of Orthopaedic Surgery
Alexandra Hospital

Address for Reprints: Dr Ngai-Nung Lo, Department of Orthopaedic Surgery, Singapore General Hospital, Outram Road, Singapore 169608.

E-mail: goclnn@sgh.com.sg

The patients' hospital bill, which shows the breakdown of cost incurred during hospitalisation, was analysed. Two hundred seventy-nine patients were reviewed. All cases sustained hip fractures from trivial trauma not normally causative of fracture. All had radiological features consistent with osteoporotic fracture. Patients found to have pathological fractures secondary to tumour, osteomalacia or osteoporosis secondary to other medical conditions were excluded.

Data were checked from the patients' casenotes on age, sex, race, fracture pattern, surgical procedure, American Society of Anesthetists (ASA) grade, complications arising from the fracture, medical co-morbidities, admission source and discharge destination and the ambulatory status at discharge using standardised data extraction forms. Information on ambulatory status and mortality rate at 1 year after the index fracture were obtained from case records, contact tracing and from records at the Singapore Registry of Births and Deaths.

Statistical analysis was carried out with the SPSS (Statistical Package for Social Sciences) software program Version 7.0. Costs and length of acute hospitalisation, ambulatory status at discharge and at 1 year post fracture, inpatient mortality rate and mortality at 1 year were readily quantified outcomes. Relationships between patient profile and these outcomes were investigated using multivariate regression analysis.

Results

Altogether, 280 consecutive patients with hip fractures were recruited. Five were excluded due to malignant pathological fractures and 1 other was excluded due to concomitant femoral fracture.

Patient Profile

The average age of the patients was 80.3 years (60 to 96 years). Sixty-eight per cent were female and 32% were male. Fifty-eight per cent were intertrochanteric fractures and 42% were femoral neck fractures. The racial distribution was as follows: Chinese, 82.5%; Malay, 8.8%; Indian, 6.9% and others, 1.8%. Seventy-six per cent were staying at their own home at the time of fracture while 22% were admitted from nursing homes. Sixty-six per cent of the patients had significant medical co-morbidities. These conditions are shown in Table I.

Treatment During Hospitalisation

95.3% of the patients were operated upon. It was the policy of the department that all patients, unless faced with high operative risk, be encouraged to undergo surgery in order to avoid the problems of prolonged recumbency associated with conservative treatment. The following procedures were carried out: dynamic compression hip

TABLE I: CONCOMITANT DISEASE

Diagnosis	%	No.
Hypertension	23.0	63
Ischaemic heart disease	20.1	55
COLD	17.9	49
Diabetes mellitus	16.4	45
Anaemia	10.2	28
Cerebrovascular accidents	8.0	22
Congestive cardiac failure	7.7	21
Dementia	6.6	18
Other concomitant fractures	5.1	14
Chronic renal failure	5.1	14
Malignancy	4.7	13
Atrial fibrillation	4.4	12
Parkinsons or psychosis	4.4	12

COLD: chronic obstructive lung disease

screw fixation (55%), hemiarthroplasty (33%) and cancellous screw fixation (7%). The remaining 4.7% were treated with bed traction.

Complications During Hospitalisation

Twenty per cent of the patients developed some form of complications during their period of hospitalisation. There were 21 patients with complications related to surgery. Fourteen were wound infections. Of these, 4 were severe enough to require further surgery to remove the infected implants. There were 2 hip dislocations after hemiarthroplasty. One was successfully treated by reduction and traction. The other progressed to recurrent dislocations and required conversion to a resection arthroplasty. There were 5 complications related to surgical technique: 3 femoral shaft fractures, 1 greater trochanter avulsion fracture and 1 sciatic nerve palsy.

Thirty-five patients had general complications. These complications were chest infection (7), urinary tract infection (5), acute urinary retention resulting in prostate surgery (5), acute myocardial infarction (3), bed sores (3), deep vein thrombosis (2), atrial fibrillation (2), congestive cardiac failure (2), chronic obstructive lung disease exacerbation (1), bleeding oesophageal varices (1), chronic renal failure exacerbation (1) and obstructed inguinal hernia (1).

Hospitalisation Costs

The patients stayed an average of 4 days pre-operation and 16 days post-operation. The average hospital bill, before government subsidy, amounted to S\$7367. The average subsidy was S\$6355, amounting to 84% of the bill. Ninety-one per cent of the cases were warded in heavily subsidised B2 and C class wards. The breakdown of costs obtained from the patients' billings is as follows: hospital

stay (42.8%), surgery (36.0%), ward treatment fee (9.3%), implant (3.6%), laboratory investigations (5.3%), drugs (1.9%) and physiotherapy (1.1%).

Multivariate linear regression was used to analyse factors contributing to costs. Thirty-one factors were investigated. They were (1) nominal factors: sex, age, admitting source, discharge destination, fracture type, operation type, post-operation complications, number and type of medical comorbidities; (2) ordinal factors: ambulatory status before fracture and at time of discharge, ASA grade and ward type; (3) ratio measurements: age and pre-operation length of stay. The factors identified were general and surgical complications, cerebrovascular accidents, preoperative sepsis and days spent waiting for elective surgery.

The final form of the predictive model is as follows:

Cost in S\$ = 5070 + 2751a + 1680b + 1543c + 311d.

a = 1 if there is operative complications or 0 if there is no operative complications

b = 1 if there is cerebrovascular accidents or 0 if there is no cerebrovascular accidents

c = 1 if there is preoperative sepsis or 0 if there is no preoperative sepsis

d = days of preoperative stay

Ambulatory Status

The premorbid ambulatory status, and the ambulatory status at discharge and at 1 year post fracture are as listed in Table II. Information were obtained from casenotes and from patients' interviews. Multivariate logistic regression analysis was used to predict factors that will significantly affect ambulatory status at discharge and at 1 year post fracture.

The factors leading to poorer outcome in ambulatory status at discharge were: age (older age), fracture type (intertrochanteric fracture) and ASA grade (high grade). One reason that intertrochanteric fractures do worse off is because the fractures are often comminuted and unstable even after fixation. As such, patients are not allowed to bear weight. Since non weight-bearing ambulation is extremely difficult for the elderly, these patients are sent home on a wheelchair. Comparing ambulatory status at discharge with respect to the method of fracture fixation clearly shows that a higher percentage of hemiarthroplasty patients are 'walkers', while a large proportion of intertrochanteric fracture patients fixed with compression hip screws go home on a wheelchair (Table III).

The ambulatory status at discharge was tabulated against the same patient's ambulatory status at 1 year (Table IV). Of the 201 patients still alive and present at follow-up at 1 year, 40% showed improvement in their ambulatory status, 43% remained unchanged and 17% showed deterioration. The length of hospitalisation with respect to the ambulatory

TABLE II: CHANGES IN AMBULATORY STATUS

	On admission n (%)	On discharge n (%)	1 year post injury n (%)
Ambulant without aids	244 (89.1)	3 (1.1)	49 (17.9)
Walking frame	14 (5.1)	103 (37.6)	39 (14.2)
Other walking aids	11 (4.0)	16 (5.8)	45 (16.4)
Wheelchair	2 (0.7)	131 (47.8)	48 (17.5)
Bedridden	3 (1.1)	6 (2.2)	20 (7.3)
Dead	—	15 (5.5)	61 (22.3)
Lost to follow-up at 1 year	—	—	12 (4.4)
Total	274	274	274

TABLE III: AMBULATORY STATUS AFTER DIFFERENT TYPES OF OPERATIONS

Operation	Ambulatory status at discharge	
	Wheelchair/ Bedridden	Walking with or without aids
Moore's hemiarthroplasty	23	58
Thompson's hemiarthroplasty	1	2
Bipolar hemiarthroplasty	—	1
Total (hemiarthroplasty)	24(28%)	61(72%)
Dynamic hip screw	93	52
Cancellous screw fixation	14	6
Total (fracture fixation)	107(65%)	58(35%)
Traction	6(67%)	3(33%)

TABLE IV: CHANGE OF AMBULATORY STATUS WITHIN THE FIRST YEAR

Status at discharge	Ambulatory status at 1 year post injury					
	Walk without aids	Walk with aids	Wheelchair	Bedridden	Dead	Missing from follow-up
Walk without aids	1	2	0	0	—	0
Walk with aids	35	50	15	3	10	6
Wheelchair	13	32	33	15	32	6
Bedridden	—	—	—	2	4	—
Dead	—	—	—	—	15	—

status at discharge is as follows: walk with aids (25 days), walk with aids (19 days), wheel ambulant (21 days) and bedridden (29 days).

The factors leading to poorer ambulatory status at 1 year post fracture were ambulatory status at discharge (wheelchair or bedridden), age (older age) and ASA grade (high grade), (Table V)

Mortality

The mortality at the acute admission was 5.5% with a

TABLE V: CORRELATION OF AMBULATORY STATUS AT 1 YEAR WITH SIGNIFICANT DETERMINANTS

	Ambulant with or without aid (%)
Ambulatory status at discharge	
Ambulant without aid	100
Ambulant with aid	83
Wheelchair	48
Bedridden	0
Age	
60's	79
70's	72
80's	64
90's	46
ASA status	
ASA 1	100
ASA 2	99.3
ASA 3	98.8
ASA 4	95
ASA 5	90

ASA: American Society of Anesthetists

total of 15 deaths. The causes of death were chest infection (6), acute myocardial infarction (5), urinary tract infection (1), chronic renal failure (1), bedsores (1) and congestive cardiac failure (1). Multivariate logistic regression analysis was developed to predict mortality. The same 31 factors were investigated. Risk factors for inpatient mortality were female gender and the presence of postoperative general complications (Table VI).

Mortality at 1 year after fracture was 22.3%. Of the 274 patients admitted with hip fractures, 61 died 1 year from the date of the hip fracture. This gave a mortality rate of 22.3% at 1 year. Multivariate logistical regression analysis showed that the following factors were associated with a higher mortality at 1 year post fracture: poor ambulatory capability at discharge and low ASA grade (Table VI).

Discussion

Singapore is facing a rapidly ageing population due to a decline in population growth rate and an increase in life expectancy. From a resident population of 2.4 million with 188,100 people aged 60 years and above in 1983, the population has grown to 2.8 million with 274,400 aged >60 years in 1993.⁴ The projected increase in those aged 60 years and above is shown in Table VII. The projected number of hip fractures based on current figures and extrapolated by the authors based on the population increase is also shown. We expect the cost of managing this increasing problem to increase six-fold without taking into account inflation costs. This projection of the increasing problem is conservative for 2 reasons. Firstly, we noted an increase in incidence of hip fractures with time, from 1.17 per 1000 females who were 60 years or older in 1957-1965 to 1.5 per

TABLE VI: CORRELATION OF MORTALITY AT DISCHARGE AND AT 1 YEAR WITH SIGNIFICANT DETERMINANTS

	Mortality rate at discharge (%)
Sex	
Male	3.4
Female	6.5
General complication	
None	0
Present	40.5
	Mortality rate at 1 year (%)
ASA status	
ASA 1	0
ASA 2	13
ASA 3	28
ASA 4	60
ASA 5	78
Ambulatory status at discharge	
Ambulant without/with aids	8.6
Bedridden or wheelchair	27.5

ASA: American Society of Anesthetists

TABLE VII: PROJECTED INCREASE IN RESIDENTS OVER 60 YEARS OLD

	1990	2000	2015	2030
60-69 y	142,539	194,600	409,100	525,000
70-79 y	77,229	107,400	166,600	389,600
>80 y	27,099	39,100	74,500	140,400
Total (>60 y)	246,867	341,000	650,300	1,055,000
No of hip fractures	787	1381	2517	4698
Costs (Million S\$)*	5.8	10.2	18.5	34.6

*At 1993 cost

1000 in 1982.⁵ Koh et al³ reported a five-fold increase in hip fracture rates in women between 1960 and 1990. Secondly, the projection does not anticipate further increases in life expectancy. These will lead to increased economic burden on society and on the health care budget. Cost effective prevention and treatment strategies dealing with osteoporotic hip fractures will be very important issues.

Interesting comparisons can be made between this study and those published in the West. In our study, 76% of the patients were admitted from home. This compares with 57% in a Swedish study⁶ and 68% in a study from the United Kingdom.⁷ Similarly, a greater proportion of our patients returned home after hospitalisation with only 26% going to a chronic nursing care facility. This may be explained by the closely knit extended family in the Asian communities; where elderly parents often live with their children who will be the primary care givers. This is a positive social attitude that should be encouraged.

The mortality rates during acute hospitalisation and at 1 year post-fracture and the proportion of patients walking at 1 year are not significantly different than those in the West. Schurch et al⁸ from the University Hospital of Geneva found an inpatient mortality of 10.4% and a 1-year mortality of 23.8%. Determinants that are correlated with mortality are mentioned in many studies,⁹ however, studies attempting regression statistical analysis to discriminate key determinants are uncommon. Incalzi RA et al¹⁰ concluded that in-hospital mortality after hip surgery in the very old cannot be predicted on the basis of underlying medical conditions alone after regression analysis.

This study of 280 hip fractures admitted to one government general hospital would be representative of the management of hip fractures in Singapore at that period of time. Private hospitals accounted for a small minority of hip fractures treated. The standard of care for hip fractures is fairly consistent throughout the government hospitals in Singapore. During the period 1991 to 1993, restructuring of the government hospitals had not taken place. The charges for medical care was standardised across the various government hospitals in Singapore, making the cost analysis in this paper representative of the cost of care in Singapore.

The cost of acute hospitalisation after a hip fracture however varies significantly. In this study, the average cost amounted to S\$7367 (US\$4645). This contrasts with \$42,000 kroners (US\$5006) in Sweden,⁶ US\$29,800 in the USA,¹¹ US\$9000 in Greece,¹² Euro 7669 (US\$6809) in Netherlands¹³ and Belgian Francs 332,148 (US\$8977).¹⁴ A significant amount of the cost of care (82%) in this study was subsidised by the government as 91% of the patients were admitted to subsidised wards.

From the cost prediction model, complications arising during hospitalisation accounted for the major amount of preventable costs. A general complication (e.g. chest or urinary tract infection, deep vein thrombosis) increases hospital stay by 11 days and raises cost by S\$2751 (37%). A complication arising from surgery (e.g. dislocation, wound infection) doubles the cost. The other significant factor is the presence of a cerebrovascular accident, which results in difficult rehabilitation and prolonged hospital stay. Discharge is delayed by a mean of 7 days, increasing the cost by an additional S\$1680 (23%). Preoperative sepsis often presenting as fever and requiring a septic workup and treatment before surgery extends hospital stay by 8 days. Cost control will require a rigorous audit of surgical care and patient selection. A dedicated operating list to reduce the waiting time for hip fracture surgery will also help cut cost.

A critical issue is that of ambulatory status at the time of discharge since this impacts upon the ambulatory status (hence the quality of life) and the mortality at 1 year post-fracture. This is also the only modifiable factor affecting mortality and mobility at 1 year post-fracture. Keeping patients longer in hospital for rehabilitation is one way to improve ambulatory capability. However, this may not be cost effective in an acute care hospital. Use of 'step-down' facilities such as community hospitals for further rehabilitation in selected patients is one way to contain cost. Another solution is to make available day-care rehabilitation facilities to patients after discharge. We conclude that early surgery, good surgical technique, aggressive inpatient physiotherapy or provision of step-down or outpatient rehabilitation facilities will help contain cost of treatment.

REFERENCES

1. Mitra A K, Low C K, Chao A K, Tan S K. Social aspects in patients following proximal femoral fractures. *Ann Acad Med Singapore* 1994; 23:876-8.
2. Nather A, Seow C S, Iau P, Chan A. Morbidity and mortality for elderly patients with fractured neck of femur treated by hemiarthroplasty. *Injury* 1995; 26:187-90.
3. Koh L K, Saw S M, Lee J J, Leong K H, Lee J. National Working Committee on Osteoporosis. Hip fracture incidence rates in Singapore 1991-1998. *Osteoporos Int* 2001; 12:311-8.
4. Lau K E. Census of population, 1990 Singapore. Release No. 1-Demographic Characteristics. Singapore: SNP Publishers, 1992:39.
5. Lee S T, Lee K O, K Bose. Osteoporosis in elderly Chinese. *BMJ* 1998; 296:1402.
6. Borgquist L, Lindelow G, Thorngren K G. Costs of hip fracture. Rehabilitation of 180 patients in primary health care. *Acta Orthop Scand* 1991; 62:39-48.
7. Pryor G A, Myles J W, Williams D R R, Anand J K. Team management of the elderly patient with hip fracture. *Lancet* 1988; 20:401-3.
8. Schurch M A, Rizzoli R, Mermillod B, Vasey H, Michel J P, Bonjour J P. A prospective study on socioeconomic aspects of fracture of the proximal femur. *J Bone Miner Res* 1996; 11:1935-42.
9. Cipitria J A, Sosa M M, Pezzotto S M, Puche R C, Bocanera R. Outcome of hip fractures among elderly subjects. *Medicina (Buenos Aires)* 1997; 57:530-4.
10. Incalzi R A, Capparella O, Gemma A, Camaioni D, Sanguinetti C, Carbonin P U. Predicting in-hospital mortality after hip fracture in elderly patients. *J Trauma* 1994; 36:79-82.
11. Cummings S R, Rubin S M, Black D. The future of hip fractures in the United States. *Clin Orthop* 1990; 252:163-6.
12. Lyrithis G. Epidemiology and socioeconomic cost of osteoporotic fractures in Greece. *Calcif Tissue Int* 1992; 51:93-4.
13. van Balen R, Steyerberg E W, Polder J J, Ribbers T L, Habbema J D, Cools H J. Hip fracture in elderly patients: outcomes for function, quality of life, and type of residence. *Clin Orthop* 2001; 390:232-43.
14. Reginster J Y, Gillet P, Ben Sedrine W, Brands G, Ethgen O, de Froidmont C, et al. Direct costs of hip fractures in patients over 60 years of age in Belgium. *Pharmacoeconomics* 1999; 15:507-14.