Original Articles/นิพนธ์ต้นฉบับ

Outcome of Early Hip Fracture Surgery in Elderly Patients in Ramathibodi Hospital: A Prospective Cohort Study

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Abstract

Background information: Early surgery in elderly hip fracture has been recently demonstrated to reduce postoperative mortality and morbidity. However, the result of this strategy is still not established in Asians population or in the patients with multiple co-morbid diseases who required advanced medial care.

Objective: To assess the 1-year outcome after treatment with early operative treatment in geriatric patients with hip fracture and compare the outcome between intracapsular and extracapsular hip fracture.

Methodology: A prospective cohort study was conducted, between 1st January 2011 and 31th December 2011, in all new elderly hip fracture patients. They were enrolled with informed consent and undergone operative treatment within 3 days after admission. Then the patients were prospectively follow-up for one-year period to evaluate the postoperative mortality and morbidity.

Results: A total of 106 patients were included. Average age was 79.2±8.0 years. Eighty-one patients (76%) had at least two co-morbid diseases before fracture. The average length of hospital stay was 7.4±4.9 days. The overall mortality rates at 30-day, 90-day, 6-month, and 1-year end point were 2.8%, 5.7%, 7.6%, and 14.3% respectively. Nineteen patients (18.1%) developed complications after surgery. Postoperative infection and sepsis was the most common cause of death (53.3%), complication (46.1%), and re-admission (73.3%). There was no significant difference in one-year mortality and morbidity between intracapsular and extracapsular hip fracture.

Summary: Early surgery after hip fracture in elderly patients demonstrated effectiveness in reducing postoperative mortality, morbidity, and length of hospital stay, especially in the patients with multiple co-morbidities.

Keywords: early surgery; elderly hip fracture; osteoporotic fracture; mortality; morbidity.

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Introduction

Elderly hip fracture is one of the major world-wide health problems and its incidence has been increasing due to increased life expectancy and population growth.[1,2] This fracture results in high mortality rate, as ranging from 14 to 36%[3-6], and associates with profound temporary and sometimes permanent impairment of independence and quality of life.[7]

Moreover, previous study showed that the 1-year treatment cost is extremely high as over a half of Thai National Gross Domestic Product per capita.[8] Recently, early operative management in patients with hip fracture was introduced and has been proved to significantly reduce postoperative mortality, morbidity, and hospital stay[9-11]. The result from meta-analysis study showed that early surgery in elderly hip fracture within 72 hours was associated with a significant reduction in mortality (relative risk [RR] 0.81, 95% confidence interval [CI] 0.68-0.96, p=0.01), in-hospital pneumonia (RR 0.59, 95% CI 0.37-0.93, p=0.02), and pressure sores (RR 0.48, 95% CI 0.34-0.69, p <0.001). However, through our knowledge, the application of the early surgery guideline and the result of this treatment approach, among Asians or Thai population, are still not established. Moreover, regarding the situation of large tertiary medical care center, such as Ramathibodi hospital, that having a high incidence of new hip fracture cases (more than 150 cases per year) and most of the patients had multiple or severe co-morbid diseases resulting in longer time for preoperative assessment, this early surgical treatment could be benefit for the patients and the medical system management. Therefore, this study aimed to report the outcome, regarding to postoperative mortality and morbidity, after the application of early surgery in elderly hip fracture patient in our hospital.

Materials and Methods

This was a single-center, prospective observational cohort study and prior approval was obtained from our institutional review board. Informed consent was obtained from all patients who participated in this study, before the surgery was scheduled, in accordance with the Declaration of Helsinki. The manuscript was prepared according to the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guideline.[12]

Eligible participants were patients diagnosed as hip fracture and received surgery in Ramathibodi Hospital from 1st January 2011 to 31th December 2011. The inclusion criteria were (1) age >50 years and sustained low-energy trauma; (2) newly diagnosed as closed femoral neck fracture, intertrochanteric fracture, and subtrochanteric fracture; (3) no contra-indication for hip surgery (severe medical condition inappropriate for surgery). The exclusion criteria were (1) operative delay than 72 hours (2) other pathological fracture such as metastatic fracture, and atypical femur fracture; (3) previous fracture on the injured hip; (4) refusing to participate in the study; (5) refusing operative treatment.

Early hip surgery protocol

After the hip fracture diagnosis was made, the patients were all sent to admit in orthopaedic or trauma ward. The rapid preoperative assessment protocol for medical clearance, including history and physical examination, preoperative laboratory investigation, and appropriate medical consultation, was performed as soon as possible after admission. The time for medical clearance and correction depends on the patients' condition and underlying disease (usually within 6-24 hour). Preoperative plan, including type of operation, implant using for internal fixation or arthroplasty, time for operation, and need of postoperative intensive care unit (ICU), was discussed and managed by the orthopaedic surgeon team. Surgery was then performed, within 3 days after admission, in the safe operative hour (9 am-6 pm), on the availability of operative room (OR), anesthesiologist team, and ICU.

Data collection

Demographic data such as age, gender, height, weight, comorbid diseases, fracture side and location, American Society of Anesthesiologists (ASA) physical status, pre-injury walking ability, time to surgery, and preoperative hemoglobin (Hb) were collected preoperatively, by first author, and then further calculated into body mass index (BMI). Time to surgery was defined as a number of days between admission and operative day. All hip fractures were classified into intracapsular and extracapsular type. Intracapsular fracture defined as subcapital and midcervical location. Extracapsular fracture defined as basicervical, intertrochanteric, and subtrochanteric fracture.

Perioperative data such as type of operation and anesthesia, operative time, perioperative blood loss, intraoperative complication, and packed red cell (PRC) transfusion, were collected by research assistant and first author. Perioperative blood loss was defined as summation of intra-operative blood loss and drainage blood loss. PRC transfusion was defined as summation of PRC used while the patients were admitted.

Postoperative data such as duration of hospital stay, incidence of death and cause of death, post-operative complication, incidence and cause of readmission, reoperation, and postoperative ambulation status, were collected by first author. All patients were then followed up for one-year period, on outpatient appointment, by telephone interview, and chart review, by first, second, and third authors.

Outcome measurement method

Mortality was defined as a death occurred after operation. Mortality rate was further calculated into 30-day, 90-day, 6-month, and one-year mortality rate. Postoperative morbidity defined as complication occurred after and related to hip fracture, including pneumonia, urinary tract infection (UTI), pressure sore, cardiac complication (myocardial infarction, heart failure), thromboembolic events (symptomatic deep vein thrombosis [DVT], pulmonary embolism [PE], and acute stroke), and fracture treatment complication (surgical site infection, periprosthetic fracture, implant failure or loosening, delayed union, and nonunion). Complication rate was collected as the number of patients having complication and the overall incidence of postoperative morbidity in follow-up period. Re-admission was defined as an incidence of admission after and related to hip fracture complication, including sepsis, infected pressure sore required debridement, cardiac failure, respiratory failure, and secondary fracture from falling.

Surgical procedure and postoperative care

All operations were preoperatively planned by orthopaedic trauma team and then were performed by one or more experienced orthopaedic surgeon. Internal fixation with multiple screws was used in non-displaced femoral neck fracture. Internal fixation with cephalomedullary nail or dynamic hip screw was used in intertrochanter or subtrochanteric fracture. Arthroplasty was used in displaced femoral neck fracture or comminuted intertrochanter fracture with severe osteoporotic bone. The decision on anesthetic technique, general or regional anesthesia, was depended on the anesthesiologists.

Postoperative care was managed by multi-disciplinary approach, including surgeon internist, medical specialist, physiotherapist, psychiatrist, and nursing team, depending on the patients' comorbid condition and existing medical problem.

Statistical analysis

Statistical analysis was performed using Stata software version 11.0 (Stata Corp, College Station, Texas, USA). Continuous data were presented as mean and standard deviation, and compared with unpaired t-test. Categorical data were presented as proportion and compared with Chi-square test or Fisher Exact

test. Significant difference was considered if p value <0.05.

Results

Participants' enrollment and allocation

From January to December 2011, there were 152 eligible elderly patients with hip fracture in Ramathibodi Hospital. Forty-six patients were excluded that including unstable medical condition unable to correct within 72 hours (twelve patients), no admission bed (eight patients), unavailable OR and postoperative ICU (twenty patients), pathological fracture (one patient with metastatic fracture, five patients with atypical femur fracture). A total of 106 patients were recruited and then allocated into intracapsular (43 patients) and extracapsular group (63 patients). During one-year study period, one patient in extracapsular group was lost in follow-up (Figure 1).

General characteristic data

Patient's general characteristic data were shown in Table 1. Twenty-eight patients were male, and 78 of them were female. The mean age of all patients was 79.2 years (range 59-96 years). Then mean BMI and preoperative Hb were 18.7 kg/m^2 (range 16.3-26.7 kg/m^2) and 11.6 g/dL (range 7.4-17.0 g/dL). Fifty-eight patients (55%) were able to walk without gait aid before injury while the rest (45%) needed gait aid or support in ambulation. Eighty-one patients (76%) had two or more comorbid disease and the most common comorbid disease was hypertension (79%), followed by diabetes mellitus (33%).

Subgroup data

The demographic data and perioperative data of intracapsular and extracapsular hip fracture patients were shown in Table 2. The mean overall duration of hospital stay was 7.4±4.9 days (3-38 days). Comparing these two groups, there was no difference in the age, gender, side of injury, BMI, number of comorbid disease, ASA physical status, pre-injury walking ability, type of anesthesia, amount of PRC transfusion requirement, and length of hospital stay. However, there were significant increases in pre-operative Hb, time to surgery, type of operation, operative time, and perioperative blood loss in the intracapsular group compared to those in extra-capsular group (p = 0.002, 0.03, <0.001, <0.001, and <0.001 respectively).

Mortality and morbidity

Postoperative mortality and morbidity data were shown in Table 3. The overall mortality rate in 30-day, 90-day, 6-month, and 1-year period were 2.8%, 5.7%, 7.5%, and 14.3% respectively. The most common cause of death was sepsis (53.3%), followed by unidentified cause (26.7%) due to the death in the patient's home without autopsy. One patient in extra-capsular group died from unrelated cause (gut obstruction from cancer metastasis) in re-admission event. There was no significant difference in mortality rate or cause of death in both groups.

During one-year follow-up period, nineteen patients (17.9%) were experienced at least one post-operative complication and there was a total of 26 postoperative complications. The most common post-o-perative complication was pneumonia (26.9%). Thromboembolic complications were occurred in 4 patients (2 in intracapsular group [one PE and one acute ischemic stroke], and two in extracapsular group [one DVT and one acute ischemic stroke]). Fracture treatment complications were occurred in 3 patients in extra-capsular group (one femoral head cutout, one implant failure, and one fracture nonunion), and none in intracapsular group.

Twelve patients (11.3%) (two patients in the intracapsular group and 10 patients in the extra-capsular group) were re-admitted in Ramathibodi Hospital after hip fracture surgery with overall 15 re-admission incidences. The most common cause

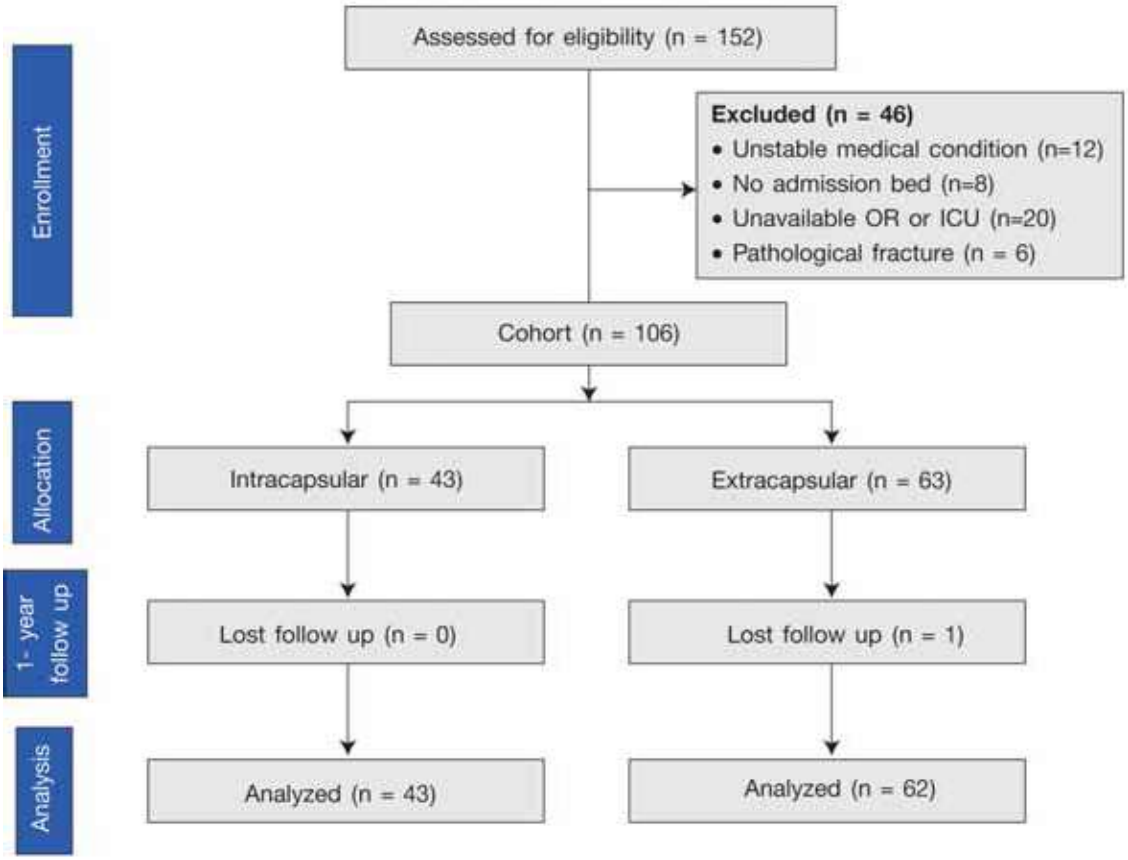

Figure 1 *Flow diagram of the study*

of re-admission was sepsis (73.3%). Secondary fractures were occurred in 3 patients in extracapsular group due to simple fall while ambulation (one recurrent hip fracture, one rib fracture, and one skull fracture).

The walking ability at one-year follow-up period showed that the proportion of patients who could walk without gait aid in the intracapsular group was significantly greater than those in the extracapsular group ($p = 0.002$).

Discussion

Hip fracture is one of major cause of mortality and morbidity among the geriatric patients, and contributes significantly to health care cost[8]. Following a hip fracture, there is a 10-20% mortality over 6 months, 50% of patients are unable to walk without assistance, and 25% of them require long-term domiciliary care[13]. Previous studies in Thai population has been demonstrated that the mortality rate in Thai elderly hip fracture patients was significantly higher than those without fracture[14], and the estimated mortality rate after hip fracture on 3-month, 6-month, 1-year period were 10%, 14%, and 18% respectively[15]. The mortality rate in these patients was associated with many factors, such as male gender, age over 80 years, presence of chronic illnesses, poor pre-injury walking ability, and non-operative treatment[5]. Recent studies from western countries showed that early operative treatment in elderly hip fracture patients significantly reduced postoperative mortality and morbidity. Therefore, we aimed to evaluate the outcome

Table 1 General characteristic data of the study participants (n=106)

Characteristic	Value
Average age (year), mean ± SD	79.2 ± 8.0
Age (year), (%)	
50-59	2 (2)
60-69	8 (8)
70-79	43 (41)
80-89	45 (42)
> 90	8 (8)
Female gender (%)	78 (74)
BMI (kg/m^2), mean ± SD	18.7 ± 1.9
Preoperative Hb (g/dL), mean ± SD	11.6 ± 1.7
Pre-injury walking ability (%)	
Walk without gait aid	58 (55)
Walk with gait aid (cane / walker)	38 (36)
Wheel chair / bed ridden	10 (9)
Type of fracture (%)	
Intracapsular	43 (41)
Extracapsular	63 (59)
Comorbidity (%)	
0-1	25 (24)
≥ 2	81 (76)
Type of comorbid disease (%)	
Diabetes mellitus	33 (31)
Hypertension	79 (75)
Thyroid disorder	10 (9)
Cardiac disease	25 (24)
COPD	19 (18)
Liver cirrhosis	2 (2)
Renal disease	22 (21)
Previous stroke	28 (26)
Dementia	16 (15)
Parkinson's disease	3 (3)
Malignancy	17 (16)

BMI; body mass index, Hb; hemoglobin, COPD; chronic obstructive pulmonary disease

Table 2 Demographic and perioperative data in the intracapsular and extracapsular subgroup

Characteristics	Intracapsular (n=43)	Extracapsular (n=64)	p-value
Average age (year), mean ± SD	78.5 ± 8.3	79.7 ± 7.7	0.45
Subgroup according to age (year) (%)			
50-59	1 (2.3)	1 (1.6)	0.78[a]
60-69	4 (9.3)	4 (6.3)	
70-79	20 (46.5)	23 (36.5)	
80-89	15 (34.9)	30 (47.6)	
≥ 90	3 (7.0)	5 (7.9)	
Female gender (%)	34 (79.1)	44 (69.8)	0.61[a]
Fracture side, right (%)	16 (37.2)	32 (50.8)	0.17[b]
BMI (kg/m^2), mean ± SD	18.8 ± 2.0	18.7 ± 1.9	0.94
No. of Comorbidity (%)			
0-1	12 (27.9)	13 (20.6)	0.50[b]
2 or more	31 (72.0)	50 (79.4)	
ASA physical status			
1-2	5 (11.6)	5 (7.9)	0.52[b]
3-4	38 (88.4)	58 (92.1)	
Pre-injury walking ability			
Walk without gait aid	29 (67.4)	28 (45.2)	
Walk with gait aid (cane/walker)	11 (25.6)	27 (43.5)	
Wheel chair/bed ridden	3 (7.0)	7 (11.3)	
Time to surgery (day), mean ± SD	1.5 ± 0.9	1.1 ± 0.9	0.03*
Regional anesthesia (%)	29 (67.4)	48 (76.2)	0.51[b]
Operation			
Fixation	3 (7.0)	59 (93.7)	<0.001[b]*
Arthroplasty	40 (93.0)	4 (6.3)	
Operative time (minute), mean ± SD	94 ± 17	71 ± 20	<0.001*
Preoperative Hb (g/dl), mean ± SD	12.2 ± 1.5	11.0 ± 2.3	0.002*
Perioperative blood loss (ml), mean ± SD	429 ± 282	153 ± 197	<0.001*
PRC transfusion (unit), mean ± SD	0.6 ± 0.9	0.8 ± 0.9	0.19
Length of hospital stay (day), mean ± SD	7.3 ± 5.2	7.5 ± 4.8	0.83

BMI; body mass index, ASA; American Society of Anesthesiologists, Hb; hemoglobin, PRC; packed red cell
p-value from unpaired t-test, [a] *p*-value from Chi-square test, [b] *p*-value from Fisher Exact test
* significant *p*-value < 0.05

Table 3 Postoperative outcome at one-year end point.

Outcome	Total (n=105)	Intracapsular (n=43)	Extracapsular (n=62)	p-value
Mortality (%)				
30-day	3 (2.8)	2 (4.7)	1 (1.6)	0.36
90-day	6 (5.7)	3 (7.0)	3 (4.8)	0.45
6-month	8 (7.6)	3 (7.0)	5 (8.1)	0.91
1-year	15 (14.3)	7 (16.3)	8 (12.9)	0.48
Cause of Death				
Sepsis	8 (53.3)	4 (57.1)	4 (50.0)	0.4[a]
Cardiac failure	2 (13.3)	2 (28.6)	0 (0)	
Unrelated cause	1 (6.7)	0 (0)	1 (12.5)	
Unidentified	4 (26.7)	2 (28.6)	2 (25.0)	
Postoperative morbidity				
No. of patients having complications (%)	19 (17.9)	6 (14.0)	13 (20.6)	0.44[b]
Overall complication incidence	26	7	19	
Pneumonia	7 (26.9)	2 (28.6)	5 (26.3)	0.56[a]
Urinary tract infection	5 (19.2)	2 (28.6)	3 (15.8)	
Pressure sore	3 (11.5)	0 (0)	3 (15.8)	
Cardiac complication	4 (15.4)	1 (14.3)	4 (21.1)	
Thromboembolic event	4 (15.4)	2 (28.6)	2 (10.5)	
Fracture treatment complication	3 (11.5)	0 (0)	3 (15.8)	
Re-admission				
No. of patients re-admitted (%)	12 (11.3)	2 (4.7)	10 (16.1)	0.38[b]
Overall re-admission incidence	15	2	13	
Sepsis	11 (73.3)	2 (100)	9 (69.2)	0.66[a]
Infected pressure sore	1 (6.7)	0 (0)	1 (7.7)	
Secondary fracture	3 (20.0)	0 (0)	3 (23.1)	
Re-operation	1	0	1	1.00[b]
Walking ability at one year (%)	(n=90)	(n=36)	(n=54)	
Walk without gait aid	33 (36.7)	21 (58.3)	12 (22.2)	0.002[a]*
Walk with gait aid (cane / walker)	41 (45.6)	12 (33.3)	29 (53.7)	
Wheel chair / bed ridden	16 (17.8)	3 (8.3)	13 (24.1)	

p-value from unpaired t-test, [a] *p*-value from Chi-square test, [b] *p*-value from Fisher Exact test

* significant *p*-value < 0.05

after application of the early surgery protocol in Ramathibodi hospital regarding to our patients' condition.

According to the results of this study, early surgery in elderly hip fracture patients demonstrated that overall one-year mortality rate was 14.3% and the overall postoperative complication was 18.1%. This result was comparable with previous studies in Thai population[5,8,14,15]. However, due to the significant higher proportion of patients with multiple comorbid diseases in our study and lower average length of hospital stay, we believed that the early surgery in elderly hip fracture was associated with a significant reduction of mortality and morbidity in our study.

Comparing the intra-capsular and extra-capsular hip fracture patients, we found that the patients in the intracapsular group had a significant higher in preoperative Hb than those in the extracapsular group but there was no significant difference in blood transfusion requirement. This may be explained by that the fracture inside capsule had less blood loss resulted in higher preoperative Hb but the common operative treatment in femoral neck fracture was arthroplasty which resulted in significant longer time to surgery, due to preoperative implant preparation, and significant greater perioperative blood loss other surgical procedure. However, there was no significant difference in mortality or postoperative complications between both groups. Considering the result of walking ability after operative treatment, the intracapsular group also had a significant higher proportion of the patients who could walk without gait aid compared to the extra-capsular group. This findings were consistent with previous study in our hospital[8] which may explained by that the arthroplasty option in the intracapsular group allowed the patients to have early ambulation and rehabilitation resulting in significant better recovery.

The present study had some limitations. Firstly, due to small population number in this study, it needed more study population to find any other possible positive or negative effect of early surgery in Thai population. Secondly, the operative treatment for hip fracture depended on indication and surgeon's preference. Therefore, the result of early surgery protocol among current situation in Thailand may needed more study in different area of Thailand before the application of this strategy will be generalized.

We concluded that early surgery in elderly hip fracture is one of the effective methods, for treating this group of patients especially in the patients with multiple comorbid diseases, for reducing postoperative mortality, complication, and length of hospital stay.

Conflict of interest

All the authors had no conflict of interest in this study.

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