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Comparison of One-year Survival Rate of Hip Arthroplasty Performed within and After 72 Hours in Elderly Femoral Neck Fracture

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Purpose: Hip fracture is a common cause of mortality in the elderly. Our study compared the one-year mortality rate in elderly femoral neck fracture who received hip arthroplasty between an early (<72 hours after admission) and delayed group (≥ 72 hours after admission).

Methods: Eighty-one patients were included in the prospective cohort study. The type of operation (total hip arthroplasty or bipolar hemiarthroplasty/cemented or cementless arthroplasty) was chosen as indicated in standard treatment, depending on a patient's cognitive function, ambulatory status, and comorbidities.

Results: The sample was 81 patients (44 in the early and 37 in the delayed groups). The one-year mortality rate was 9.9% (4.5% in the early and 16.7% in the delayed group; P =0.079). The mean survival time was 11.47 months (11.97 months in the early and 10.88 months in the delayed group (P= 0.094, HR = 3.93)). Operations performed within 72 hours decreased the one-year mortality rate. Subgroup analysis showed that the early surgery group had a lower one-year mortality rate than the delayed group without preoperative medical conditions (P = 0.011, HR = 8.08).

Conclusions: There was no significant difference in the one-year mortality rate between the early and delayed surgery groups. Early surgery was associated with improved mean survival time and a significant reduction in one-year mortality in elderly patients with femoral neck fractures. Early surgery is recommended for these patients to reduce immobilization time, postoperative complications and improve survival.

Keywords: Hip Arthroplasty, Elderly, Femoral Neck Fracture, Mortality, Bipolar hemiarthroplasty

Hip fracture is a common and important cause of mortality and morbidity in the elderly worldwide. The one-year mortality rate after hip fracture of these patients is 20-30%. [1-2]

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The high mortality rate is probably due to major surgery in older adults with concurrent medical problems. Identifying which patients are at the greatest risk of developing complications and the time to operation is crucial[3].

The occurrence of hip fractures in Thailand is about 185.2 per 100,000 in a community survey[4]. Femoral neck fracture is one of the most common consequences of injuries[5].

The mortality rate after hip fracture is very high due to immobilization and loss of ability to perform daily activities. During the first year, the

mortality rate is 18%. The median survival time is at 6 years[6].

The one-year mortality was eight times higher than the age-matched general population, and the 10-year mortality rate was up to 68%.[7]

Most patients require surgery to prevent the morbidities from bedridden statuses, such as pneumonia, urinary tract infection, pressure sore, or thromboembolic events, and to improve the quality of life to decrease the one-year mortality rate but the optimum timing of operation remains controversial[8].

Treatment type depends on the patient's condition (physical status before the injury, age, perception, and underlying diseases)[9]. Hip arthroplasty is the treatment of choice for displaced femoral neck fractures in older adults over 60[10,11]. Several studies have demonstrated that a delay in operation increases morbidity and mortality[1,2]. However, some studies show differences in results[10,12].

In Thailand, factors correlated with higher mortality were non-operative treatment, delayed surgical treatment, and absence of medical treatment for osteoporosis[13].

The demand for urgent surgery in many healthcare systems often exceeds the available resources. This study aimed to determine the optimum timing for surgery, to find out associated factors of mortality, and to compare the one-year mortality rate in elderly patients who received hip arthroplasty within and after 72 hours of admission time.

METHODS

This is a prospective cohort study. The study was approved by Ethic Committee (IRB No.034/62). Patients older than 60 with unilateral displaced femoral neck fractures were enrolled. Patients with MET (metabolic equivalents) <4, paraparesis or paraplegia, hemiparesis or hemiplegia, Parkinson's disease, pathologic fracture secondary to malignancy, history of previous surgery of the ipsilateral hip, and fracture duration less than 1 month were excluded.

Demographic, surgical, and anesthetic data were collected, and background variables associated with mortality were included.

The type of operation (total hip arthroplasty or bipolar hemiarthroplasty/cemented or cementless arthroplasty) was chosen as indicated in standard treatment, depending on a patient's cognitive function, ambulatory status, and comorbidities. Routine preoperative investigations include complete blood count, creatinine, blood urea nitrogen, electrolyte levels, electrocardiography, and chest radiograph.

All surgery was performed as soon as possible after the patient's preoperative status was ready and performed by a single hip and knee certificated surgeon. Early surgery was defined as surgery within 72 hours after hospitalization. Surgery performed after this time was considered to be delayed. All patients receive prophylactic antibiotics (Ceftriaxone and Fosfomycin), pain control with oral paracetamol, opioids (oral tramadol, parenteral morphine), and parecoxib adjusted with the patient's renal function and thromboembolic prophylaxis with low molecular weight heparin (enoxaparin) adjusted with patient's renal function at the first postoperative day if there were no contraindications.

The case analysis began at the time of hospitalization and ended one year later, or on the day the patient died. Mortality rate and timing from hospitalization to mortality, postoperative complications (pneumonia, urinary tract infection (UTI), pulmo-nary embolism, deep vein thrombosis, and surgical site infection), cause of death, and functional outcome at one year (Harris Hip Score) were collected.

Statistical analysis

Chi-square tests and the T-test were used to determine the basic data. Kaplan-Meier survival analysis was done to find the association between mortality and time to surgery. Hazard ratios were analyzed to compare the risk between the two groups, and multivariate analyses were adjusted for variable factors. The SPSS statistical program (version 12.0.1; SPSS, Chicago, Illinois) and

Microsoft Excel 2000 were used. The analysis was undertaken under the supervision of a statistician.

RESULTS

From February 2019 to February 2020, 81 patients were enrolled in the study (44 in the early group and 37 in the delayed group). Demographic data for the two groups are shown in Table 1; there were no significant differences between the groups.

The mean age was 74.82 years in the early and 76.95 in the delayed group. Of the 37 patients in the delayed group, 16 were due to medical morbidity that required treatment and preoperative evaluation (Table 2), and 21 were due to an unavailable operating room.

One-year mortality rate

Overall, the one-year mortality rate in this study was 9.9% (2 patients from the early group and 6 patients from the delayed group). This difference was insignificant (X2 = 3.076; p = .079), as shown in Table 3. The causes of death in the early group were acute kidney injury and home death. The causes of death in the delayed group were cerebrovascular disease, upper gastrointestinal bleeding, intracranial hemorrhage, respiratory failure due to pulmonary tuberculosis, sepsis, and home death.

Hip arthroplasty performed	Survival rate (%)	Survival time (month) Mean	(95% CI)	Hazard ratio	(95% CI)	p-value
Within 72 hours	95.5	11.97	(11.93-12.02)	Ref.		
More than 72 hours	83.8	10.88	(9.94-11.82)	3.93	(0.79-19.46)	0.094
Overall	90.1	11.47	(11.03-11.92)			

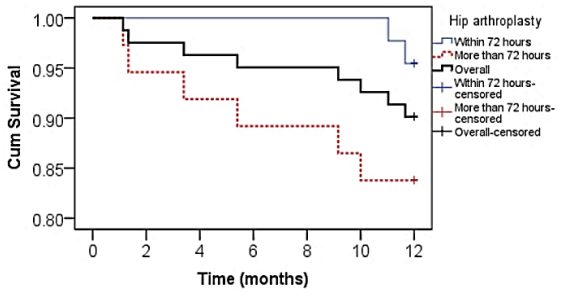

Fig.1 Survival Curve of elderly femoral neck fracture.

According to the survival analysis in Figure 1, the overall one-year survival rate was 90.1% (95.5% in the early group and 83.3% in the delayed group). The mean survival time is 11.47 months (95%CI: 11.03-11.92) which is longer in the early group. Moreover, there was a greater risk of mortality in the delayed group (hazard ratio: 3.93)

This result suggests that early arthroplasty decreases one-year mortality of elderly femoral neck fracture and improves mean survival time but not statistically significant at one year follow-up (P-value: 0.094).

Subgroup analysis between patients in delayed group without preoperative medical condition and patients in the early

The results show that the early group had a lower one-year mortality rate than patients without preoperative medical conditions in the delayed group. (P = 0.011, OR = 8.08, 95%CI = 1.27-90.44)

Factor associated with mortality

To compare the mortality that was adjusted with associated factors using Chi-square test (as shown in Table 4) demonstrated that there was the statistical of increasing of one-year mortality rate with the patient who had lower body mass index (BMI < 18.5).

Postoperative complications and mortality

Using the Chi-square test, there was a statistically significant increase in mortality rate among patients who developed a urinary tract infection postoperatively. (Table 5)

Furthermore, according to logistic regression analysis to evaluate a more accurate association of BMI, UTI, and mortality. This analysis reveals that individuals exposed to postoperative UTI were more likely to die 10.14 times than those without postoperative UTI. Moreover, BMI increased incrementally by 1 unit then the odds of mortality increased by 1.394 times. (Table 6-8)

Postoperative complications and time to surgery

There were no significant occurrences of pneumonia, urinary tract infection, pulmonary embolism, and surgical site infection between early and delayed groups, as shown in Table 9 by using the Chi-square test (there was no evidence of deep vein thrombosis in our study).

Functional outcome at one year (Harris Hip Score) and time to surgery

Seventy-two patients attended our outpatient department one year after admission. We assessed functional outcomes by Harris Hip Score (HHS). There was no significant difference in HHS between the early and delayed groups by using the Mann-Whitney Test since the data was not normal distribution as shown in Table 10 (U = 490.50, p = .098).

Table 1 Demographic data (n = 81).

Data	Total		Hip arthroplasty				P-value
			Within 72 hours		More than 72 hours		
	n	%	n	%	n	%	
Age (year)							
<80	54	66.7	31	70.5	23	62.2	0.430
80+	27	33.3	13	29.5	14	37.8	
Mean ± S.D. [T]	75.79 ± 8.10		74.82 ± 8.18		76.95 ± 7.97		0.242
Sex							
Male	16	19.8	7	15.9	9	24.3	0.343
Female	65	80.2	37	84.1	28	75.7	
BMI (kg/m²)							
<23.00	52	64.2	23	52.3	29	78.4	
23.00+	29	35.8	21	47.7	8	21.6	
Mean ± S.D. [T]	21.36 ± 3.46		21.98 ± 3.62		20.62 ± 3.15		0.079
Comorbidity							
Total	65	80.2	33	75.0	32	86.5	0.196
DM	23	28.4	11	25.0	12	32.4	0.460
HT	57	70.4	30	68.2	27	73.0	0.638
DLP	38	46.9	20	45.5	18	48.6	0.774
COPD [F]	3	3.7	-	-	3	8.1	0.091
Gout [F]	5	6.2	3	6.8	2	5.4	>0.999
CKD [F]	5	6.2	1	2.3	4	10.8	0.173
Type of Anesthesia							
GA	42	51.9	20	45.5	22	59.5	0.209
SA	39	48.1	24	54.5	15	40.5	
Type of treatment							
BHA	46	56.8	26	59.1	20	54.1	0.649
THA	35	43.2	18	40.9	17	45.9	
Smoking [F]							
Yes	3	3.7	2	4.5	1	2.7	>0.999
No	78	96.3	42	95.5	36	97.3	

*Statistically significant at p-value<0.05 determined by Chi-square test, [F] Fisher's exact test, and [T] T-test.

Table 2 Reasons for delayed group.

Reasons	n	%
Electrolyte imbalance/anemia	2	12.5
Uncontrolled blood pressure/dysrhythmia	1	6.25
Uncontrolled blood sugar	1	6.25
Fever	3	18.75
Pulmonary tuberculosis screening	1	6.25
Current oral anticoagulant	3	18.75
Other medical conditions	5	31.25
Total	**16**	**100**

Table 3 One-year survival rate between having surgery within and longer than 72 hours.

	< 72 hours (n=44)	> 72 hours (n=37)	Total	P-value
Death	2	6	8 (9.9%)	0.079
Survive	42	31	73 (90.1%)	

Table 4 Comparison of mortality rate with associated factors (categorical variables).

Factors	Death	Survive	X^2
Age			
<65	0 (0%)	7 (100%)	3.721 (p=0.239)
65-74	3 (10%)	27 (90%)	
75 – 84	2 (6.5%)	29 (93.5%)	
>85	3 (23.1%)	10 (76.9%)	
Gender			
Male	2 (12.5%)	14 (87.5%)	0.154 (p=0.154)
Female	6 (9.2%)	59 (90.8%)	
BMI**			
<18.5	5 (27.8%)	13 (72.2%)	8.713 (p=0.033)
18.5-22.9	2 (3.5%)	33 (94.3%)	
23.0-24.9	1 (6.3%)	15 (93.8%)	
25.0-29.9	0 (0%)	12 (100%)	
>30	0 (0%)	0 (0%)	
Smoking	0 (0%)	3 (100%)	0.341 (p=0.559)
Comorbidity			
DM	4 (17.4%)	19 (82.6%)	2.038 (p=1.530)
HT	4 (7.0%)	53 (93%)	1.767 (p=0.184)
Dyslipidemia	2 (5.3%)	36 (94.7%)	1.712 (p=0.191)
COPD	0 (0%)	3 (100%)	0.341 (p=0.559)
Gout	0 (0%)	5 (100%)	0.584 (p=0.445)
CKD	0 (0%)	5 (100%)	0.584 (p=0.445)
Intraoperative data			
ASA			
1	0 (0%)	1 (100%)	0.225 (p=0.973)
2	1 (10%)	9 (90%)	
3	7 (10.1%)	62 (89.9%)	
4	0 (0%)	1 (100%)	
Type of anesthesia			
GA	6 (14.3%)	36 (85.7%)	1.905 (p=0.167)
SA	2 (5.1%)	37 (94.9%)	
Operation			1.200 (p=0.273)
BHA	6 (13.0%)	40 (87.0%)	
THA	2 (5.7%)	33 (94.3%)	
Estimated blood loss			0.640 (p=0.424)
≤200 ml	4 (13.3%)	26 (86.7%)	
>200 ml	4 (7.8%)	47 (92.2%)	
Time to surgery (hours)			3.831 (p=2.800)
<24	1 (5.3%)	18 (94.7%)	
24-47	0 (0%)	0 (0%)	
48-71	1 (5.0%)	19 (95%)	
72-95	0 (0%)	7 (100%)	
>96	6 (17.1%)	29 (82.9%)	

X^2 Statistically significant at p-value<0.05 determined by Chi-square test

Table 5 Comparison of variables between groups (n = 81) (continuous variables).

		N	Mean	SD	t	df	Sig	95% CI	
								Upper	Lower
Age	dead	8	79.25	8.22	1.277	79	.205	-2.144	9.823
	survive	73	75.41	8.06					
BMI*	dead	8	18.29	2.94	-2.757	79	.007	-5.865	-.947
	survive	73	21.69	3.35					
Admission cost	dead	8	75008.88	23120.45	-.360	79	.720	-16801.971	11658.597
	survive	73	77580.56	18771.51					

*Result: There was difference in BMI between groups (t = -2.757; p = .007) but no difference in age and admission cost. df: degree of freedom

Table 6 Comparison of mortality rate with postoperative complications.

Complications	Death	Survive	X^2
Pneumonia	0 (0%)	3 (100%)	0.341 (p=0.559)
UTI*	5 (38.5%)	8 (61.5%)	14.215 (p=.0001)
PE	0 (0%)	1 (100%)	0.111 (p=0.739)
DVT	0 (0%)	0 (0%)	-

X^2 Statistically significant at p-value<0.05 determined by Chi-square test

Table 7 Odd ratio of mortality and postoperative urinary tract infection.

Exp (B)	P	OR (CI)
UTI	.002	13.542 (95% CI 2.710-67.661)

Table 8 Logistic regression analysis of UTI, BMI, and mortality.

Exp (B)	P	OR (CI)
UTI	.008	10.140 (95% CI 1.847 – 55.683)
BMI	.044	1.394 (95% CI 1.008 – 1.927)

Table 9 Postoperative complications and time to surgery.

	< 72 hours (n=44)	> 72 hours (n=37)	X^2
Pneumonia			
No	43 (97.73%)	35 (94.59%)	0.553 (P=0.457)
Yes	1 (2.27%)	2 (5.41%)	
UTI			
No	40 (90.91%)	28 (75.68%)	3.462 (P=0.630)
Yes	4 (9.09%)	9 (24.32%)	
Pulmonary embolism			
No	43 (97.73%)	37 (100%)	3.544 (P=0.998)
Yes	1 (2.27%)	0	
Surgical site infection			
No	43 (97.73%)	36 (97.30%)	0.015 (P=0.901)
Yes	1 (2.27%)	1 (2.70%)	

X^2 Statistically significant at p-value<0.05 determined by Chi-square test

Table 10 HHS and time to surgery.

		N	Mean rank	U	P
HHS score	<72 hours	41	40.04	490.50*	.098
	>72 hours	31	31.82		

*Determined by Mann Whitney U test

DISCUSSION

Elderly patients with fractures around the hip have a higher mortality rate than patients without fracture[1]. The association between timing to surgery and mortality rate is controversial[14-17]. The study of Schermann et al. did not find any statistical difference between 30 days-mortality and time to surgery[18]. Mitchell et al. also did not find an adverse affect outcome at 30 days from delay in hip fracture surgery[19]. Earlier surgery was associated with a lower risk of death and lower rates of postoperative complications such as pneumonia and pressure sores among elderly patients[20]. Some studies show that early surgery was not associated with improved function or mortality. However, it was associated with reduced pain and LOS and probably major complications among patients medically stable at admission[21]. Nowadays, the majority of studies show the benefits of early surgery. Our results demonstrated that delayed surgery up to 72 hours in elderly femoral neck fracture does not significantly affect the one-year mortality rate. However, early surgery improved the mean survival time and survival rate in the early group compared with patients without preoperative medical conditions but in the delayed group. It should be recognized that if we followed up with a longer period of more than one year, the mortality rate would be statistically significant between the early and delayed groups.

The association between postoperative complications, functional outcome (Harris hip score) and surgery timing were not statistically significant. However, the patients with lower body mass index and postoperative urinary tract infection were more likely to die within one year after hospitalization.

As described above, we suggest that elderly patients with femoral neck fractures should be prioritized to avoid a longer immobilization period, decrease postoperative complications such as urinary tract infections and improve survival time.

There are several limitations to this study. First, the small sample size may not allow for generalization to other populations. Additionally, data on the severity of comorbidities that could affect one-year mortality was not available. Finally, a longer follow-up period than one year may be necessary to find a statistically significant difference in mortality rate.

CONCLUSIONS

There was no statistical significance in the one-year mortality rate between the early and delayed groups. However, we suggest that elderly patients with femoral neck fractures should be prioritized because the result shows that early surgery improves mean survival time and significantly lowers one-year mortality in subgroup analysis between patients in the early group compared to the delayed group without a preoperative medical condition. Early surgery would be beneficial to avoid a longer immobilization period, decrease postoperative complications such as urinary tract infections and improve mean survival time.

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