การศึกษาความสัมพันธ์ระหว่างวันรอผ่าตัดและความสามารถในการเดินด้วยเครื่องช่วยเดิน 4 ขาในผู้ป่วยสูงอายุที่ผ่าตัดเปลี่ยนข้อสะโพกเทียมไม่มีเบ้าชนิด 2 ชั้น

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บทคัดย่อ

กระดูกสะโพกหักเป็นหนึ่งในปัญหาที่พบบ่อยส่งผลกระทบต่อคุณภาพชีวิตผู้สูงอายุ ประเทศไทยการรอผ่าตัดในโรงพยาบาลรัฐอาจทำให้เกิดความล่าช้า โดยอาจนานเกิน 48 ชั่วโมงหลังเข้ารับการรักษาตามคำแนะนำของสถาบันแพทย์ศัลยกรรมกระดูก ประเทศสหรัฐอเมริกา (AAOS) ที่โรงพยาบาลพุทธโสธรวันรอผ่าตัดเปลี่ยนข้อสะโพกเฉลี่ยอยู่ที่ 4.95±3.05 วัน โดยผู้ป่วยร้อยละ 45.54 ได้รับการผ่าตัดภายใน 3-4 วันหลังเข้ารับการรักษา การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาระยะเวลารอผ่าตัดก่อนการเปลี่ยนข้อสะโพกเทียมไม่มีเบ้าชนิด 2 ชั้นส่งผลต่อผู้ป่วยในการเดินด้วยอุปกรณ์ช่วยเดิน 4 ขาก่อนออกจากโรงพยาบาลและระยะเวลานอนโรงพยาบาลหรือไม่ ข้อมูลย้อนหลังผู้ป่วยจำนวน 112 ราย ที่โรงพยาบาลพุทธโสธรระหว่างปี 2017-2022 ชี้ให้เห็นว่าการผ่าตัดเปลี่ยนข้อสะโพกเทียมที่ล่าช้าไม่เกิน 4 วันหลังเข้ารับการรักษา ให้ผลในการเดินและระยะเวลานอนโรงพยาบาลเฉลี่ยเทียบเท่าทางสถิติกับกลุ่มที่ได้รับการผ่าตัดภายใน 2 วัน แม้ Fisher's exact test พบว่าสัดส่วนของผู้ป่วยที่เดินได้ใกล้เคียงกัน การวิเคราะห์ Log-rank ของระยะเวลาคอยผ่าตัด ≤4 วัน เทียบกับ >4 วัน บ่งชี้ว่าผู้ป่วยมีโอกาสกลับมาเดินด้วยอุปกรณ์ช่วยเดินเพิ่มขึ้น 1.65 เท่า (p=0.005) จาก Kruskal-Wallis และ Dunn's post-hoc test พบว่าระยะเวลานอนโรงพยาบาลของกลุ่มที่ผ่าตัด ≤2 วัน 3-4 วัน และ ≤4 วัน ไม่มีความแตกต่างกันอย่างมีนัยสำคัญ โดยมีระยะเวลา 6.61±3.13, 6.67±3.24 และ 6.65±3.19 วัน ตามลำดับ อย่างไรก็ตาม การผ่าตัดที่ล่าช้าเกินกว่า 4 วัน ทำให้ระยะเวลานอนโรงพยาบาลเพิ่มขึ้นอย่างมีนัยสำคัญ 8.40±3.46 วันเทียบกับกลุ่มที่ผ่าตัด ≤4 วัน (p=0.015) นอกจากนี้ Log-rank hazard ratio ระหว่างการรอผ่าตัดที่ ≤4 วัน และ >4 วัน แสดงให้เห็นว่าการรอผ่าตัดที่ไม่เกิน 4 วันช่วยให้การฟื้นตัวของการเดินด้วยอุปกรณ์ช่วยเดินเร็วขึ้น 1.56 เท่า (p=0.043) และลดระยะเวลานอนโรงพยาบาลได้ 1.57 เท่า (p=0.037) จากการศึกษานี้บ่งชี้ว่าการผ่าตัดที่ล่าช้าเกินกว่า 4 วันหลังเข้ารับการรักษาผ่าตัดเปลี่ยนข้อสะโพกเทียมไม่มีเบ้าชนิด 2 ชั้น ส่งผลเสียต่อการเดินของผู้ป่วย ในทางกลับกันความล่าช้าไม่เกิน 4 วันไม่ส่งผลกระทบต่อการเดิน อีกทั้งมีระยะเวลานอนโรงพยาบาลและระยะเวลาเริ่มเดินที่น่าพอใจ ซึ่งข้อมูลนี้อาจช่วยให้แพทย์เตรียมความพร้อมผู้ป่วยเพื่อให้มั่นใจในความปลอดภัยของผู้ป่วยก่อนดำเนินการผ่าตัดเปลี่ยนสะโพก

<u>คำสำคัญ:</u> กระดูกคอสะโพกหัก; การผ่าตัดเปลี่ยนข้อสะโพกเทียมไม่มีเบ้าชนิด 2 ชั้น; วันรอผ่าตัด

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The study of the correlation between the waiting day before surgery and the walking ability with a 4-leg-walker in bipolar hemiarthroplasty elderly patients

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Abstract

Femoral neck fracture is one of the most prevalent problems affecting elderly patients' quality of life. In Thailand, presurgical processes in public hospitals may lead to delays, subsequently resulting in long waiting times for surgery, which often exceed the 48 hours post-admission per recommendation by the American Academy of Orthopaedic Surgeons (AAOS) Clinical Practice Guideline Summary: Management of Hip Fractures in Older Adults. Since the average waiting duration for hip replacement surgery was 4.95±3.05 days with 45.54% of patients receiving surgery within 3-4 days of admission at Buddhasothorn Hospital, this study aimed to examine whether prolonged waiting duration before bipolar hemiarthroplasty surgery impacts the patient's outcome in terms of walking ability with a 4-leg-walker before discharge from the hospital and length of stay post-surgery (LOS). Retrospective analysis of the data registry of 112 patients at Buddhasothorn Hospital between 2017-2022 suggested that bipolar hemiarthroplasty delayed by up to 4 days post-admission had walking outcomes and average LOS statistically equivalent to those who had surgery within 2 days post-admission. Although Fisher's exact test showed proportions of patients who could walk before hospital discharge were similar, Log-Rank analysis suggests 1.65-fold of patients who had surgery ≤4 days could walk with a gait aid before hospital discharge compared to patients who had surgery after 4 days (p=0.005). Kruskal-Wallis test and Dunn's post-hoc test revealed that LOS of groups that had surgery within ≤2 days, day 3-4, and ≤4 days showed no significant differences with the mean±SD of 6.61±3.13, 6.67±3.24, and 6.65±3.19 days, respectively. However, delays of more than 4 days post-admission led to a significant increase in average LOS of 8.40±3.46 compared to groups that had surgery within ≤4 days (p=0.015). Furthermore, Log-Rank hazard ratio analysis of relationships between ≤4 days and over >4 days pre-surgery waiting period showed 1.56-fold faster recovery of walking ability with gait aid (p=0.043) and reduced LOS by 1.57-fold (p=0.037). These findings provided data suggesting that potential delays of more than 4 days post-admission before bipolar hemiarthroplasty adversely affected patient outcomes. Furthermore, delays of up to 4 days post-admission had negligible effects on walking outcomes with favorable LOS and duration to walking, and this extended period may enable physicians to perform necessary investigations to ensure the patient's safety before proceeding with hip surgery.

Keywords: femoral neck fracture; bipolar hemiarthroplasty; surgical waiting day

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Introduction

The WHO identified Thailand in 2023 as one of the nations experiencing rapid aging, forecasting that in the coming ten years, 28% of its population will consist of senior citizens[1]. Hip fracture is one of the most common health problems in the elderly demographic. Due to increased overall life expectancy worldwide, the incidence of hip fractures in elderly patients has risen and has become one of the primary health concerns for the healthcare systems of many countries, including Thailand[2,3]. Multiple studies have suggested the enhanced risk of both morbidity and mortality in hip fracture patients[4,5]. Hip fractures in elderly patients lead to the inability to walk, deteriorating the patient's quality of life. Walking disability for hip fracture patients has been associated with an increase in 1-year mortality[6] and excessive long-term care costs that affect the patients and their families[7]. A recent epidemiologic report of hip fractures in Thailand revealed that the incidence of hip fractures and the annual hospitalization costs for hip fractures increased significantly from 2013 to 2022[8].

Bipolar hemiarthroplasty is a popular treatment option for elderly patients with femoral neck fractures[9]. Bipolar hemiarthroplasty surgery has been shown to yield good post-operative outcomes, where most patients will be able to walk with a 4-leg gait aid. The study by Schneppendahl et al. reported that out of 487 patients who were followed for 91 months after surgery, 67% of patients regained their ability to walk using walking aids[10].

Despite the general acceptance of the optimal surgical procedure, the timeframe for preparing elderly patients with femoral neck fractures before undergoing hip surgery remains controversial and varies across studies[11-13]. Some studies recommend surgery within 24 to 48 hours of hospital admission which is the best practice in terms of reducing the length of hospital stay, bedsores, regaining independence, and postoperative mortality rate[11-16]. In contrast, some studies reported that a delay in hip surgery does not adversely affect postoperative outcomes nor is it associated with any complications or mortality rate[17-19]. A recent study from Harvard Medical School also suggested that delaying the time to hip surgery is not significantly associated with complications after surgical treatment of hip fractures[20]. This study is controversial since the standard treatment guideline for hip fractures indicates that the surgery should be performed within 48 hours of patient admission[16,21] to reduce potential complications. In terms of postoperative outcomes, the study has reported that the timing of the surgery after a hip fracture does not affect postoperative outcomes or mortality, but likely reduces pain, length of stay, and risks of significant complications[22]. Therefore, further studies and discussions about the optimal waiting duration before hip surgery should be conducted.

According to the American Academy of Orthopaedic Surgeons (AAOS) clinical practice guideline[16,21], performing hip surgery within 48 hours according to hip fractures treatment guidelines may not be possible in

all cases. Additionally, rural hospitals in Thailand are often limited by factors such as insufficient personnel, unavailability of operating theatres and other operational limitations on weekends or public holidays[23], leading to the inability for patients to undergo surgery within 48 hours. The current study investigated retrospective data of hip surgery cases performed between the year 2017-2022 at Buddhasothorn Hospital, Chachoengsao province, Thailand.

Due to multiple limiting factors, particularly delays associated with preoperative co-morbidity evaluations, Buddhasothorn Hospital has been unable to perform hip surgery on the majority of patients within 48 hours. However, to ensure that these delayed periods of hip surgery did not affect the patient's optimal outcome, the objective of this study was to determine the relationship between the duration before surgery, length of stay, and walking ability with a 4-leg walker before a patient is discharged from the hospital after bipolar hemiarthroplasty. The results from this study will help provide further information about the possible extension of the pre-operational "golden period" which does not adversely affect the patient's outcome while enabling flexibility applicable to rural hospitals with limited resources. The information obtained from this study may also contribute to the amendment of current hip surgery treatment guidelines.

Materials and Methods

This research was a cross-sectional study. It was approved by the Human Ethics Committee of Buddhasothorn Hospital (BSH-IRB 002/2566). Data was collected retrospectively from medical records of patients who underwent bipolar hemiarthroplasty at the Orthopedic Department, Buddhasothorn Hospital, from January 1st, 2017 to January 31st, 2022.

Study population

Since the data set acquired included patients aged 58-98 years old, the inclusion criteria were Thai patients aged 58 years and over, both male and female, who had a history of falling from a standing height, resulting in femoral neck fractures. The diagnosis of the femoral neck fracture was done by hip X-ray. Then, the patients received bipolar hemiarthroplasty at the Buddhasothorn hospital. Exclusion criteria, patients who delay hospital visits for more than 7 days after they had the fracture would be excluded from the study.

From data collection, a total of 118 patients were diagnosed with femoral neck fractures from January 1st, 2017 to January 31st, 2022. Out of 118 patients with femoral neck fracture cases, only 112 patients met the inclusion criteria for this study. Four patients were excluded because they delayed their hospital visit for more than 7 days after they had the hip fracture. Two patients were excluded as they received Austin Moore unipolar hemiarthroplasty (Figure 1a). Therefore, the data of 112 patients who underwent bipolar hemiarthroplasty and met the criteria were collected.

Data collection

The patients' demographic data were collected from medical records, including gender, age, and underlying diseases. American Society of Anesthesiologists (ASA) classification and Hemoglobin (Hb) level before surgery were collected to ensure no differences between the preoperative conditions of the patients included in the study. Additionally, the date of admission, duration before bipolar hemiarthroplasty of the hip, length of hospital stays, and the number of patients who regained the ability to walk with a 4-leg walker after surgery before hospital discharge were collected. The patients were divided into groups according to the duration of waiting days before surgery. The differences between each group were analyzed by statistical analysis.

The primary outcome was defined as the ability to walk with gait aid before discharge. In this case, the walking outcome was defined as a binary variable: able to walk with a gait aid versus unable to walk before discharge. Functional recovery was defined as the ability to regain walkability post-hip surgery, including with gait aid. The secondary outcomes were the patient length of stay after surgery (LOS) and the duration to walking with gait aid after surgery.

Statistical analysis

Statistical analyses were performed using GraphPad Prism version 10.4.2. All data presented in this study were shown as mean ± SD. Normality tests were performed for all data analyzed. The patients were divided into groups based on the waiting duration before hip surgery. Demographic data were analyzed using one-way ANOVA with Tukey's post-hoc test for Parametric data and Kruskal-Wallis test with Dunn's post-hoc test for non-parametric data. The proportion of patients able to walk with gait aid before discharge was analyzed using Fisher's exact test. The analysis of patient length of stay (LOS) was analyzed using Kruskal-Wallis test with Dunn's post-hoc test. Statistical differences between groups and hazard ratio were analyzed using Log-Rank (Mantel-Cox) test. The statistical significance level was set at 0.05.

Results

Patients' demographic data

Retrospective data were collected from medical records of patients aged 58 years and over, who had a history of standing falls resulting in femoral neck fractures and received bipolar hemiarthroplasty surgery at Buddhasothorn Hospital between January 1st, 2017 to January 31st, 2022. Out of 118 patients with femoral neck fracture cases, only 112 patients met the inclusion criteria for this study (Figure 1A). Between 2017 and 2022, the waiting period for hip surgery at Buddhasothorn Hospital ranged from 1 to 14 days, and the average waiting duration was 4.95±3.05 days after admission. Only 16.07% of patients received hip surgery within 2 days after admission as recommended by the AAOS clinical practice guideline[16,21]. However, 45.54% of the patients admitted at Buddhasothorn Hospital received surgery between 3-4 days

after admission, while 38.39% received surgery after 4 days (Figure 1B-C). This indicated that most patients at Buddhasothorn Hospital received surgery after admission, exceeding the timeframe recommended by the practice guideline[16,21].

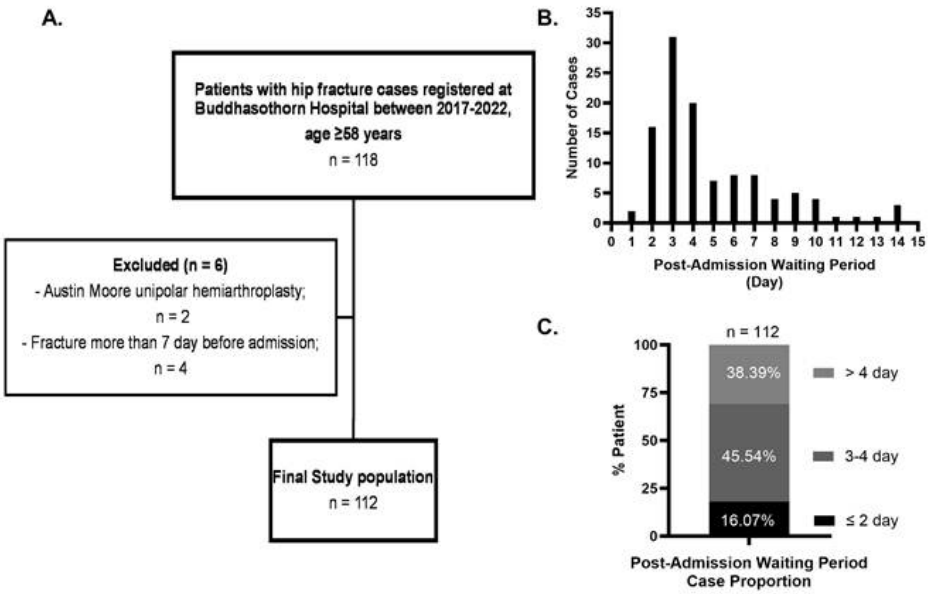

Figure 1 Flowchart of the study population and the proportion of post-admission waiting period patients

The current study aimed to identify whether these pre-surgical delays affected the outcomes of hip surgery compared to the standard recommendation, where patients should receive hip surgery within 48 hours. Therefore, the patients included in this study were firstly divided into three main groups: 1) patients who received surgery within 2 days, 2) patients who received surgery on day 3-4, and 3) patients who waited for surgery for more than 4 days (Table 1).

Demographic data of 112 patients with femoral neck fractures who underwent bipolar hemiarthroplasty were analyzed to ensure that patients of the study groups were similar. The patients included in this study had an age range of 58-98 years. The common chronic diseases found in the patients of both study groups were high blood pressure, diabetes, hypercholesterolemia, and chronic kidney disease. The patient's average age, ASA score, and preoperative hemoglobin levels were not significantly different between these three groups, implying that patients within these groups were comparable (Table 1).

Table 1 Demographic data of the patient who had surgery within 4 days compared to more than 4 days after admission

	Surgery ≤ 2 days after admission n = 18 (%)	Surgery on day 3-4 after admission n = 51 (%)	Surgery > 4 days after admission n = 43 (%)	*p*-value
Gender				
Female	13 (72.22.)	45 (88.24)	31 (72.09)	0.262
Male	5 (27.78)	6 (11.76)	12 (27.91)	
Age (year)				
Average	74.5±8.07	75.49±8.21	75.79±8.28	0.854
Underlying diseases				
Diabetes	4 (22.22)	23 (45.10)	15 (34.88)	0.208
Hypertension	11 (61.11)	43 (84.31)	23 (53.49)	0.004
Hypercholesterolemia	5 (27.78)	24 (47.06)	8 (18.60)	0.012
Chronic kidney disease	1 (5.56)	7 (13.73)	3 (6.98)	0.575
Other diseases	7 (38.89)	4 (7.84)	5 (11.63)	0.011
ASA score				
Grade I	3 (16.67)	16 (31.37)	4 (9.30)	0.288
Grade II	14 (77.78)	28 (54.09)	34 (79.07)	
Grade III	1 (5.56)	7 (13.73)	5 (11.63)	
Hb level before surgery (g/dl)				
Mean±SD	13.77±7.57	18.14±10.71	19.96±12.49	0.390

N = number of patients; ASA = American Society of Anesthesiologists Classification; Hb = Hemoglobin; Gender, and Underlying diseases statistical comparisons were performed by Fishers' exact test. Hb and ASA score were compared using Kruskal-Wallis Test. Age were compared using One-way ANOVA.

Hip surgery waiting duration of >4 days showed a decreasing trend in the proportion of patients able to walk with gait aid before discharge

To compare whether the post-admission waiting period between the recommended ≤2 days, the hospital's average of ≤4 days and more than 4 days affected patients' treatment outcomes, the patients' ability to walk with a gait aid and length of hospital stay were investigated. To ensure that delay of 3-4 day post-admission does not affect walking outcomes, patients included in the study were divided into four groups: 1) patients who received surgery within 2 days, 2) patients who received surgery on day 3-4, 3) patients

who received surgery within 4 days and 4) patients who waited for surgery for more than 4 days.

The proportion of patients who were able or unable to walk using a 4-leg walker before discharge from the hospital was compared (Figure 2A). Data suggested negligible differences between groups that had surgery within 2 days, on 3-4 days, and ≤4 days, where 77.78%, 76.47%, and 76.81% were able to walk using a 4-leg walker before hospital discharge, respectively. However, the group of patients who received hip surgery >4 days post-admission showed a notable decrease in proportions able to walk with a 4-leg walker (62.97%). Overall, this result suggested that an increased waiting duration before surgery showed a trend decrease in favorable walking outcomes. However, groups that had surgery within 2 days, on 3-4 days, and ≤4 days had relatively similar outcomes.

Hip surgery waiting duration of ≤4 days reduces hospital length of stay

Another favorable treatment outcome was the patient's reduced length of stay (LOS) at a hospital. To ensure that delay of 3-4 day post-admission does not affect length of stay, differences in the LOS were compared between 1) patients who received surgery within 2 days, 2) patients who received surgery on day 3-4, 3) patients who received surgery within 4 days, and 4) patients who waited for surgery for more than 4 days. Data suggested that post-admission duration to surgery between ≤2 days, day 3-4, and ≤4 days showed no significant differences in the LOS with the mean ± SD of 6.61±3.13, 6.67±3.24, and 6.65±3.19 days, respectively. On the contrary, patients who waited for more than 4 days before hip surgery had significantly longer LOS of 8.40±3.46 days (Kruskal-Wallis, Dunn's post-hoc test; 3-4 day vs. >4 day p=0.0358 and ≤4 day vs. >4 day p=0.015), as shown in Figure 2B.

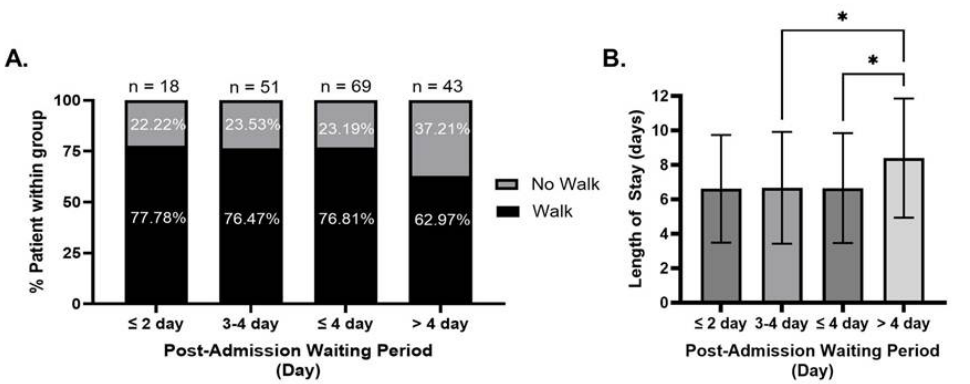

Figure 2 The proportion of patients able to walk, comparing intervals of waiting time before surgery and outcome before discharge

Pre-surgery waiting duration of ≤4 days favors recovery outcomes, including reduced time to walk with gait and decreased LOS

Since the differences between the groups that had surgery within 2 days, on 3-4 days, and ≤4 days were similar, further study should focus on comparing patients who had surgery within 4 days and after 4 days of hospital admission. The patients' potential to regain walking ability before hospital discharge is a key desirable outcome of hip surgery. The current study used the Kaplan-Meier curve and hazard ratio obtained from log-rank analysis to identify favorable outcome occurrences. The relationships between post-admission waiting duration to surgery and regaining walking ability with gait aid, time to walking ability with gait aid, and LOS were investigated.

Log-Rank analysis revealed that the hazard ratio of patients who underwent bipolar hemiarthroplasty within 4 days post-admission and regained the ability to walk with gait aid was 1.65-fold (p=0.005) higher than that of patients who waited more than 4 days for bipolar hemiarthroplasty. This suggests that the successful walking outcomes with gait aid is better in groups of patients who had ≤4 day waiting period compared to groups who had to wait >4 days (Table 2).

This study also investigated whether ≤4 or >4 days pre-surgery waiting influenced the duration of regaining walking ability using walking aids. Significant differences between the mean duration required for a patient to walk with a gait aid are 4.40±2.72 and 5.86±3.42 days for pre-surgery waiting periods of ≤4 or >4 days, respectively. The hazard ratio result suggested that the patients who underwent bipolar hemiarthroplasty within 4 days post-admission and regained the ability to walk with a gait aid were 1.56-fold (p=0.043) higher than that of patients who waited more than 4 days, suggesting that a ≤4 day waiting period was favorable for a faster functional recovery (Table 2).

Longer patient length of stay at the hospital is an essential factor that reduces the hospital's efficiency and increases the extent of healthcare burdens. This study found that the mean LOS of patients who had ≤4 and >4 days pre-surgery waiting periods were 6.65±3.19 and 8.40±3.46, respectively. The results suggested that patients who had a ≤4 days waiting period had significantly lower LOS. Furthermore, the log-rank analysis of LOS and ability to walk with a gait aid before discharge indicated that the risk ratio of patients who had a ≤4 days waiting period was 1.57-fold (p=0.037) higher than that of patients who waited more than 4 days. This suggested that ≤4 days waiting period was favorable for reducing the length of hospital stay and better functionality outcomes (Table 2).

Table 2 Log-rank analysis of relationships between the pre-surgery waiting period, the ability to walk with a gait aid before discharge, the duration to functional recovery and LOS

	Surgery ≤ 4 days after admission N = 69 (%)	Surgery > 4 days after admission N = 43 (%)	Statistical significance *p*-value
Ability to walk with a gait aid before discharge mean (SD)			
Able to walk	53 (76.81)	31 (72.09)	Odd ratio = 1.96[a]
Unable to walk	16 (23.19)	12 (27.91)	0.084[a]
Duration to walking with gait aid mean (SD)			
Average	4.40±2.72	5.86±3.42	0.044[b]
LOS mean (SD) in days			
Average	6.65±3.19	8.40±3.46	0.046[b]
Log-rank hazard ratio	A/B	B/A	
Ability to walk with gait aid	1.65	0.61	0.005[c]
Duration to walking with gait aid	1.56	0.64	0.043[c]
LOS	1.57	0.64	0.037[c]

[a] = Fisher's exact test; [b] = Kolmogorov-Smirnov d test; [c] = Log-rank (Mantel-Cox) test

Discussion

Bipolar hemiarthroplasty is a commonly chosen treatment option for elderly patients with femoral neck fractures[9], however, the optimal pre-surgical waiting duration remains controversial. Generally, the AAOS clinical practice guidelines and recommendations suggested that surgical treatment without delay would yield the best clinical outcome by reducing the risks of complications, pain, and mortality rate[11,15,21]. Previous studies recommended that bipolar hemiarthroplasty for hip fracture should be performed within 24-48 hours after hospital admission[15,24]. Conversely, some studies showed that delaying hip surgery beyond the recommended timeframe did not affect the patients' functional outcome and mortality rate[18,20]. At present, discussions regarding the optimal window for performing bipolar hemiarthroplasty in hip fracture patients are still ongoing.

Fergus L., et al[25]. reported that only 24% of femoral neck fracture patients could undergo surgery within 24 hours of hospital admission due to non-medical reasons. Lau TW., et al[26]. Indicated that surgeries are commonly delayed due to the following reasons: 1) no standard for ordering preoperative X-rays from the time the patient arrives in the emergency room, 2) no standard for ordering blood tests in preparation for surgery in the orthopaedic surgery ward, and finally, the leading cause of delay 3) unnecessary medical problems, one of which is referral for cardiac examinations.

In Thailand, between 2013-2024, a study by Charatcharoenwitthaya N., et al[8].

reported significant increases in hip fracture incidences, rising annual hospitalization costs, and healthcare burden. Although hip surgery is recommended to be performed within 24-48 hours after admission, these procedures are often delayed beyond 48 hours at Buddhasothorn Hospital and other public hospitals due to limited resources and operational constraints[27]. Limitations in staffing, diagnostic instruments, and operational theatres resulted in long waiting times, prolonging the duration to diagnosis and delaying management decisions. Moreover, routine and non-urgent surgeries are often scheduled on weekdays, further prolonging the duration of hip surgery. For Buddhasothorn Hospital, between 2017-2022, the average time to hip surgery for 112 admitted patients included in the study was 4.95±3.05 days, where the majority (45.54%) received surgery on days 3-4, and 61.61% of admitted patients were treated within 4 days. This raises the point of whether such delays affect hip surgery outcomes, particularly bipolar hemiarthroplasty.

The optimal postoperative outcome of bipolar hemiarthroplasty is the patient's ability to walk before hospital discharge, even with the use of walking aids. Regaining the ability to walk has been associated with better long-term outcomes and increased quality of life[10]. Additionally, evidence suggested that patients with good scores on the Time Up and Go (TUG) test, assessing functional mobility and balance, were more likely to have good recovery outcomes[28]. Hence, multiple studies often selected the ability to walk before hospital discharge as the primary desirable outcome to evaluate bipolar hemiarthroplasty outcomes[29]. However, the proportions of patients who were able to walk after hip surgery vary between reports.

In this study, the ability to walk before hospital discharge is deemed the primary desirable outcome to evaluate whether pre-surgical delays beyond 2 days affected functional outcomes. Biswas BK, et al.[29] and Maini PS, et al.[30] reported that performing bipolar hemiarthroplasty within 2 days post-admission resulted in 74%-75% of their patients regaining good walkability. Consistent with previous reports, our results showed that patients who had received bipolar hemiarthroplasty procedures within 2 days post-admission had a success rate of 77.78%.

On the contrary, Mitchell SM, et al.[17] reported that delaying hip surgery beyond 2 days did not affect postoperative outcomes but increased LOS. Relatively similar, our data suggested negligible differences between the proportion of admitted patients who received surgery within the recommended period (2 days) and those who had surgery on days 3-4 post-admission, where more than 75% of the patients regained their ability to walk with a 4-leg gait aid before discharge. Moreover, the average LOS of patients who had surgery within 2 and 4 days was similar. For groups of patients who waited for surgery for more than 4 days, there was a significant increase in LOS and a noticeable decrease in the proportion of patients who could walk before discharge. Therefore, these results suggest the potential

to increase the pre-surgery waiting timeframe from within 2 days to within 4 days without adversely affecting the patient's functional outcome.

Since the outcome of bipolar hemiarthroplasty did not differ between having surgery ≤2 days or ≤4 days, this study investigated whether the pre-surgery period of ≤4 days and >4 days were different. This study used log-rank analysis to compare the frequency or rate of events that occurred (hazard ratio). Compared to a more than 4-day pre-surgery period, patients who received surgery within 4 days had a 1.65-fold higher chance of being able to walk with a gait aid before discharge. These patients were also 1.56 times faster at recovering walking ability and had a 1.57 times shorter rate of LOS. Reduced LOS is highly beneficial in reducing the cost burden of the hospital while providing bed space for newer patients to be admitted.

Our results suggest that the waiting time for bipolar hemiarthroplasty in elderly patients could be extended to 4 days without producing adverse events and outcomes. This 4-day extended preoperative waiting duration would provide a beneficial period to perform crucial confirmatory tests, such as an echocardiogram, to ensure the safety of elderly patients. Furthermore, this extended waiting duration would reduce the hospital burden on the surgery queue, the insufficiency of medical personnel, and limited working hours on the weekend. Nevertheless, bipolar hemiarthroplasty surgery should be performed as soon as possible to reduce the patient's suffering, improve pain control, reduce LOS, and reduce other potential complications that may arise due to a delay in surgery.

A limitation of this study is that it is a retrospective data analysis. As such, controlling variables that potentially affected the study is impossible. Additionally, this is a single-center data collection, and the data may not be suitable for extrapolation in any context.

Conclusions

Retrospective data analysis from this study shows that even patients with hip fractures who had bipolar hemiarthroplasty delayed by up to 4 days had walking ability equivalent to those who had surgery within 2 days, as recommended by the AAOS clinical practice guideline. Therefore, potential delays of up to 4 days before bipolar hemiarthroplasty may provide the necessary time to optimally ensure the patient's safety before proceeding with hip surgery, as well as reduce hospital logistical burdens.

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