Physical Medicine & Rehabilitation Journal
ISSN# 2834-3247

Research Article

Postoperative Rehabilitation Goals to Prevent Deep Venous Thrombosis Following Emergent Hip Fracture Surgery in Elderly Female Patients

Nishimura H[1], Onoyama Y[1], Komatsu T[1], Tahara K[1], Nakashima M[2] and Hayashi Y[3*]

[1]Rehabilitation, Yoka Municipal Hospital, Japan

[2]Clinical laborateory, Yoka Municipal Hospital, Japan

[3]Anesthesiology, Yoka Municipal Hospital, Japan

ARTICLE INFO

Received Date: July 02, 2025
Accepted Date: July 08, 2025
Published Date: July 09, 2025

KEYWORDS

Complication; Deep venous thrombosis; Risk factors; Elderly female patients; Operation; Hip fracture; Emergency surgery; Rehabilitation; Bed rest; First ambulation

Citation for this article: Nishimura H, Onoyama Y, Komatsu T, Tahara K, Nakashima M and Yukio Hayashi. Postoperative Rehabilitation Goals to Prevent Deep Venous Thrombosis Following Emergent Hip Fracture Surgery in Elderly Female Patients. Physical Medicine & Rehabilitation Journal. 2025; 1(1):136

Corresponding author:
Yukio Hayashi,
Anesthesiology Service, Yoka Municipal Hospital, 1878-1, Yoka, Yoka-cho, Yabu, Hyogo, 667-5555, Japan, Tel: + 81-79-662-5555; Fax: 81-79-662-3134;
Email: yhayashi@anes.med.osaka-u.ac.jp

ABSTRACT

Background: Deep venous thrombosis of the lower extremities is a serious postoperative complication after hip fracture surgery due to its potential progression to pulmonary embolism. In our recent study, we identified dementia as a significant risk factor for postoperative deep venous thrombosis in elderly female patients undergoing emergency orthopedic surgery for the lower extremity and we supposed that dementia is associated with delays in postoperative rehabilitation, which may contribute to the increased risk of DVT in this population.

Objective: To clarify clinical significance of postoperative rehabilitation strategies in preventing postoperative deep venous thrombosis in elderly female patients undergoing hip fracture surgery.

Design: Retrospective observational study

Setting: A community hospital in a rural area

Participants: Ninety-three female patients who underwent emergent hip fracture surgery

Methods: The following data were extracted from electrical medical records to identify significant risk factors for postoperative deep venous thrombosis: patient characteristics (age, height, weight and body mass index); preoperative comorbidities (diabetes, hypertension, and atrial fibrillation); anti-coagulation treatment prior to injury; presence of preoperative deep venous thrombosis; anesthesia/operation variables (anesthesia method, duration, open reduction and internal fixation surgical procedure); postoperative rehabilitation data (duration of bed rest and time to the ambulation after surgery. Multivariate logistic regression model was used for data analysis.

Results: Deep venous thrombosis was identified in 17 patients, representing 18.3 % of the sample. Multivariate analysis identified time to first ambulation after surgery as a significant factor for postoperative deep venous thrombosis.

Conclusion: Time to first ambulation was identified as a significant risk factor for postoperative deep venous thrombosis in elderly female patients undergoing surgical treatment for hip fractures.

INTRODUCTION

Deep Venous Thrombosis (DVT) in the lower extremities is a serious postoperative complication following hip fracture surgery due to its potential progression to pulmonary embolism. Several risk factors for DVT after hip fracture surgery have

been previously reported [1-4]. In our recent report, we identified dementia as a significant risk factor for DVT in elderly female patients undergoing emergency orthopedic surgery for lower extremity [5]. We hypothesize that delayed postoperative rehabilitation due to dementia may be contributing to the development of postoperative DVT. A previous review [6] reported that "Bed rest > 3 days" is a weak risk factor for DVT, suggesting that early mobilization after the surgery may play a role in the prevention of postoperative DVT. On the other hand, Kanel et al. [7] reported that time to ambulation did not relate to the development of DVT after hip fracture surgery. Based on these findings, the present study was designed as a subsequent study to our previous report [5] to evaluate the clinical significance of postoperative rehabilitation – particularly early ambulation – in preventing postoperative DVT in elderly female patients undergoing surgical treatment for hip fractures.

METHODS

This retrospective study was approved by the IRB of Yoka Municipal Hospital (Yoka Municipal Hospital IRB ID: 2024-02; approval date: July 1, 2024) and was registered in the UMIN Clinical Trial Registry (UMIN 000047975). Informed consent was waived due to the retrospective design. Clinical data were collected from female patients with hip fractures who were hospitalized and underwent surgical intervention between January 2020 and December 2022. Inclusion criteria were: (1) The ability to walk independently or with crutches and to perform activities of daily living prior to the fracture, and (2) Availability of complete medical records for review. Exclusion criteria were: (1) Cognitive impairment and inability to participate in rehabilitation training, (2) Non-weight bearing during postoperative rehabilitation, (3) Serious medical conditions precluding postoperative rehabilitation. A total of 93 subjects met the inclusion and exclusion criteria.

All patients were managed according to a standardized clinical pathway. This included mechanical thromboprophylaxis involving intermittent pneumatic compression pumps and thromboembolic deterrent open toe knee-length compression stockings, chemical prophylaxis (heparin or edoxaban) initiated on the first postoperative day, and routine ultrasound examination of the lower extremities preoperatively and on 7th postoperative day. The following data were extracted from electronic medical records to identify potential risk factors for postoperative DVT: patient characteristics: age, height, weight and BMI; preoperative comorbidities: diabetes, hypertension, and atrial fibrillation; anti-coagulation treatment prior to injury; preoperative DVT status; anesthesia and operation data: anesthesia method, duration of anesthesia, and performance of Open Reduction and Internal Fixation (ORIF) ; postoperative rehabilitation data: duration of bed rest and time to first ambulation.

DVT（+）was defined as the new onset or progression of DVT as determined by comparison of postoperative day 7 ultrasound findings with preoperative imaging findings. This study was designed as a follow-up to our previous report [5], using the same study period (January 2020 - December 2022). We collected 93 subjects to satisfy the inclusion and exclusion criteria. We planned to analyze the data and to perform the power of analysis, if needed. As shown in "Results" we identified significant factors in this patient population, so we showed these results in this report.

STATISTICAL ANALYSIS

Data were expressed as mean ± SD or number (%), as appropriate. Statistical analysis was done with EZR Ver. 1.64 (Saitama Medical Center, Jichi Medical University, Saitama, Japan). To determine the multivariate model inputs, qualitative variables were analyzed using the Chi-square test, and quantitative variables were analyzed using the unpaired *t* test between DVT (+) and DVT (-) groups. Variables with a P value < 0.2 in univariate analysis were included in multivariate logistic regression analysis. A P value < 0.05 was considered statistically significant.

RESULTS

The patient's demographic data and univariate analysis are presented in Table 1. The mean age of the cohort was 83.1 years (SD: 9.8). DVT (+) was identified in 17 patients representing 18.3 % of the sample. Variables with a P value < 0.2 in the univariate analysis including age, BMI, duration of anesthesia and time to the first ambulation after surgery were entered into the multivariate logistic regression model (Table 1) and time to first ambulation after surgery was identified as a significant risk factor for DVT (+) (p = 0.046) (Table 2). The

distribution of time to first ambulation after surgery is presented in figure 1. More than half of the patients (52 %) were able to ambulate by the second postoperative day.

Table 1: Univariate analysis of factors associated with the development of deep venous thrombosis (DVT) after surgery.

	Overall	DVT (+)	DVT (-)	P value
Number	93	17	76	
Demographic data				
Age (year)	83.1 ± 9.8	85.9 ± 8.7	82.5 ± 10	0.18
Height (cm)	148 ± 6.5	149.9 ± 7.3	147.8 ± 6.3	0.25
Weight (kg)	45.6 ± 10	44.1 ± 14.5	46.0± 8.8	0.48
BMI	20.7 ± 3.7	21.0 ± 3.3	19.4 ± 4.9	0.11
Comorbidities before the operation				
Hypertension	60 (64.5)	12 (70.6)	48 (63.2)	0.78
Diabetes	15 (16.1)	2 (11.8)	13 (17.1)	0.73
Atrial fibrillation	9 (9.7)	3 (18.7)	6 (7.9)	0.25
DVT before the operation	18 (19.4)	4 (23.5)	23 (30.3)	0.62
Anesthesia/operation data				
General /Spinal anesthesia	52/41	8/9	44/32	0.25
Duration of anesthesia (min)	99 ± 41	83 ± 31	102 ± 43	0.09
ORIF	66 (71.0)	13 (80.6)	53 (69.7)	0.58
Postoperative rehabilitation				
Duration of bed rest after surgery (days)	1.9 ± 1.4	2.3 ± 2.3	1.8 ± 1.1	0.22
Time to first ambulation (days)	3.3 ± 2.1	4.4 ± 2.9	3.1 ± 1.9	0.02

DVT: deep venous thrombosis, ORIF: open reduction and internal fixation
DVT (+) indicates cases in which DVT either newly developed or worsened postoperatively.
Data were expressed as mean ± SD or the number of patients (%).

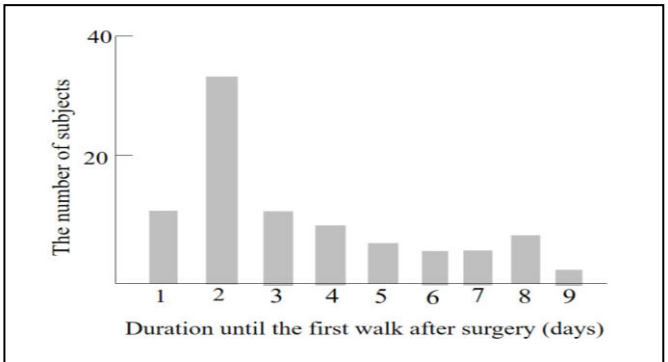

Figure 1: Distribution of the time to first postoperative ambulation.

DISCUSSION

The present multivariate analysis identified time to first ambulation after surgery as a significant risk factor for DVT in elderly female patients undergoing surgical treatment for hip fractures. Early postoperative rehabilitation is widely recognized as essential to prevent functional decline and complications in patients with hip fractures [8]. A previous review by Pastori et al. [1] mentioned that prolonged bed rest is a risk factor for DVT. Similarly, a previous study by Song et al. [9] showed that preoperative incidence of DVT in the patients undergoing elective femoral neck fractures surgery was associated with longer bed rest. Based on these findings, we hypothesized that early mobilization after surgery contributed to prevention of DVT and evaluated the two important factors for postoperative rehabilitation. Although our data did not support a significant association between duration of bed rest and DVT, we found that a shorter time to first ambulation was significantly associated with the lower risk of DVT (Table 1,2).

Table 2: Multivariate analysis of significant risk factors for newly developed or worsened DVT following the operation.

Variable	Odds ration	95 % CI	P value
Age	1.02	0.96 – 1.1	0.51
BMI	0.85	0.71 – 1.03	0.10
Duration anesthesia (min)	0.99	0.97 – 1.0	0.11
Time to first ambulation (day)	2.344	0.714 – 7.692	0.046

CI: Confidence Interval

Current guidelines for patients with hip fractures recommends initiating rehabilitation on the first postoperative day [10] and our rehabilitation team consistently adhered to this standard. Consequently, as shown in Figure 1, over half of the patients were able to ambulate by the second postoperative day and the mean duration of bed rest was about 2 days in both groups (Table 1). By contrast, in Song's study [9] the mean duration of bed rest was 7.9 days in the DVT group and 4.6 days in the non-DVT group. This discrepancy may reflect differences in study timing -preoperative versus postoperative. Our results suggest that while bed rest duration is important, the timing of first ambulation may be a more important clinically relevant target for DVT prevention. Some patients may experience postoperative hip pain, which may delay initial ambulation, even if early mobilization from bed rest is

achieved. The present findings suggest that collaborative efforts by the medical staffs to facilitate early ambulation after surgery is clinically important for the prevention of DVT.

There are several factors which were identified as a significant or a protective risk factor for DVT in the previous reports, but were not confirmed in the present study. Fu et al. [1] showed ORIF surgical procedure as an independent protective factor for DVT. Dou et al. [2] reported that age, general anesthesia, duration of anesthesia are risk factors for DVT. In contract, our findings are inconsistent with these prior reports. We speculate that this discrepancy may be attributed to the characteristics of our study population and limited sample size. First, all the data were obtained from a single community hospital located in a rural area where the aging population is more pronounced than in urban areas. Thus, we have to acknowledge that the generalizability of our findings to other populations may be limited. Second, the small sample size, ninety-three, compared with the previous reports [1,2] may have reduced the statistical power to detect certain associations.

In the present study, we excluded the patients with cognitive impairment and inability to undergo rehabilitation training, non-weight bearing during rehabilitation after surgery and serious medical problems that make postoperative rehabilitation intolerable. These exclusion criteria were applied to standardize the postoperative rehabilitation strategy and to clarify the definite postoperative rehabilitation goals to prevent DVT. Therefore, caution is warranted when generalizing out findings to the broader population of patients with hip fractures. Notably, a previous study by Kamel et al. [7], which did not restrict its cohorts as narrowly, found no association between time to ambulation and the development of DVT after hip fracture surgery.

Dementia is a characteristic disease with cognitive impairment and inability to participate in rehabilitation training. As the population ages, the number of patients with both dementia and hip fractures is expected to increase. Thus, similar analysis in patients with dementia may be considered as a future research priority to improve the rehabilitation strategies following hip fracture surgery [11]. We are currently planning a follow-up clinical study to investigate rehabilitation goals to prevent DVT in patients with dementia.

There are some limitations in this study. First, we did not account for all potential risk factors for DVT. We have to acknowledge that there might be more meaningful factors to predict DVT. Finally, the retrospective nature of this study introduces potential bias, as perioperative management strategies were not standardized.

CONCLUSION

The present multivariate analysis identified time to the first postoperative ambulation as a significant risk factor for DVT in female patients undergoing surgical treatment for hip fractures.

ACKNOWLEDGMENTS

The authors would like to thank Ms. Ririka Tomita for language editing.

This study received financial support from Medical Research Fund of Hyogo Medical Association.

DISCLOSURES

The authors have no conflict of interest to declare.

REFERENCES

1. Fu YH, Liu P, Xu X, Wang PF, Shang K, et al. (2020). Deep vein thrombosis in the lower extremities after femoral neck fracture: A retrospective observational study. J Orthop Surg. 28: 1-7.
2. Dou C, Tianhua L, Yang S, Geng Q, Lu Q, et al. (2022). Epidemiological status and risk factors of deep vein thrombosis in patients with femoral neck fracture. J Orthop Surg Res. 17: 41.
3. Wong KL, Daruwalla ZJ, Lan CJH, Tan SHS, Shen L, et al. (2014). Postoperative venous thrombotic events in Asian elderly patients with surgically treated hip fractures with and without chemoprophylaxis. Hip Int. 24: 650-655.
4. Zhuang Q, He Q, Aikebaier A, Chen W, Liu J, et al. (2023). The risk factors for new-onset calf muscle venous thrombosis after hip fracture surgery. J Pers Med. 13: 257.
5. Kishida K, Nakashima M, Onoyama Y, Tomi K, Hayashi Y. (2025). Analysis of risk factors for deep venous thrombosis after emergency orthopedic surgery for the lower extremity in elderly female patients. Ann Surg Perioper Care. 10: 1072.
6. Pastori D, Cormaci VM, Marucci S, Franchino G, Del Sole F, et al. (2023). A Comprehensive Review of Risk Factors for

Venous Thromboembolism: From Epidemiology to Pathophysiology. Int J Mol Sci. 24: 3169.

7. Kamel HK, Iqbal MA, Mogallapu R, Maas D, Hoffman RG. (2003). Time to ambulation after hip fracture surgery: Relation to hospitalization outcomes. J Gerontol Med Sci. 58A: 1042-1045.
8. Agarwal N, Feng T, Maclullich A, Duckworth A, Clement N. (2024). Early mobilization after hip fracture surgery is associated with improved patient outcomes: A systematic review and meta-analysis. Musculoskeletal Care. 22: e1863.
9. Song K, Yao Y, Rong Z, Shen Y, Zheng M. (2016). The preoperative incidence of deep vein thrombosis (DVT) and its correlation with postoperative DVT in patients undergoing elective surgery for femoral neck fractures. Arch Orthop Trauma Surg. 136: 1459-1464.
10. Min K, Beom J, Kim BR, Lee SY, Lee GJ, et al. (2021). Clinical Practice Guideline for Postoperative Rehabilitation in Older Patients With Hip Fractures. Ann Rehabil Med. 45: 225-259.
11. Smith TO, Gilbert AW, Sreekanta A, Sahota O, Griffin XL, et al. (2020). Enhanced rehabilitation and care models for adults with dementia following hip fracture surgery. Cochrane Database Syst Rev. 7: 2.