



Prevention of Venous Thromboembolism in Patients Undergoing Hip Fracture Surgery: A Survey of the Korean Hip Society

Chang Hyun Kim, MD, Je-Hyun Yoo, MD, PhD*, Young-Kyun Lee, MD, PhD[†],
Ye-Yeon Won, MD, PhD[†], Jong-Seok Park, MD, PhD

Department of Orthopedic Surgery, Soonchunhyang University Hospital Cheonan, Cheonan, Korea

Department of Orthopedic Surgery, Hallym University Sacred Heart Hospital,

*Hallym University School of Medicine, Anyang, Korea**

Department of Orthopedic Surgery, Seoul National University Bundang Hospital, Seongnam, Korea[†]

Department of Orthopedic Surgery, Ajou University College of Medicine, Suwon, Korea[†]

Purpose: The aim of this study was to assess the current status of venous thromboembolism (VTE) prevention in Korean patients with hip fractures.

Materials and Methods: A survey using a questionnaire on the experiences and protocols of VTE prevention was conducted among 570 members of the Korean Hip Society.

Results: A total of 97 surgeons responded, with a response rate of 17.0%. Of the 97 participants, 61.9% answered that they had encountered one or more cases of symptomatic VTE in the past year. Mechanical prophylaxis was applied most often (30.9%) until the point of ambulation in standard-risk patients and most often (34.0%) extended until discharge in high-risk patients. Chemical prophylaxis was most often prescribed for a particular period of time rather than for recovery of walking ability (24.7% in standard-risk patients and 26.8% in high-risk patients). Dual prophylaxis was administered in the standard-risk group by 58.8% of the participants and in the high-risk group by 83.5%. Among the participants, 73.2% answered that they had been attentive to wound complications during chemical prophylaxis. More than half of the participants (59.8%) reported that they did not perform routine screening for VTE after surgery.

Conclusion: The results of our survey provided information regarding the current status of VTE prevention for patients undergoing surgery for treatment of hip fractures in Korea as well as a baseline for establishment of educational programs and guidelines in the future.

Key Words: Hip fractures, Thromboembolism, Anticoagulants

Submitted: January 27, 2023 **1st revision:** April 21, 2023

Final acceptance: April 24, 2023

Address reprint request to

Jong-Seok Park, MD, PhD

(<https://orcid.org/0000-0002-0225-0500>)

Department of Orthopedic Surgery, Soonchunhyang University

Hospital Cheonan, 31 Suncheonhyang 6-gil, Dongnam-gu,

Cheonan 31151, Korea

TEL: +82-41-570-2176

E-mail: jsparksch@schmc.ac.kr

Chang Hyun Kim and Je-Hyun Yoo contributed equally to this study as co-first authors.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

As the population of elderly persons increases, managing complications following hip fractures has become even more critical. Patients with hip fractures are at high risk of venous thromboembolism (VTE), the second most common complication after surgery for treatment of hip fractures¹⁾. The risk of VTE was >20-fold higher for patients undergoing surgery for treatment of hip fracture compared with those undergoing simple gynecological surgery and until relatively recently the rate of VTE after surgery for treatment of hip fracture showed an annual increase in Korea²⁾. The reported incidence of VTE in patients with hip fractures ranges from 1.6-11.1% in Korea^{2,3)}. This condition can be life-threatening for patients, and surgeons could be faced with legal issues and psychological burdens. Based on these issues, various guidelines for prevention of VTE have been suggested in Western societies. However, the reported incidence of VTE after surgery for treatment of hip fractures is lower in Asians compared with that in Caucasians⁴⁾, therefore, application of Western guidelines in Korea may be associated with problems such as unnecessary treatment or complications. In addition, most of the guidelines are more than 10 years old. Therefore, determining the current status of VTE prevention in hip fracture patients in Korea can provide important information for use in re-establishing standardized guidelines and educational programs. The aim of this study was to examine the level of awareness and current status of VTE prevention with regard to the treatment of hip fractures in Korean patients.

MATERIALS AND METHODS

A survey questionnaire on protocols for prevention of VTE was administered to 570 members of the Korean Hip Society using Google forms in July 2022. The questionnaire was developed by the authors based on the VTE prevention guidelines. There were no inclusion or exclusion criteria for respondents. The survey was conducted over a period of 10 days. Data were collected automatically when the respondent filled in the answers, and the respondent’s personal information was not included. A total of 97 surgeons participated in the questionnaire-based survey, with a response rate of 17.0% (Table 1). The questions were related to (i) experiences with VTE events in the past year, (ii) protocol for prevention of VTE in standard/high-risk patients, (iii) identification of risk factors for screening groups at high risk for VTE before surgery, and priority of the risk factors, (iv) method and dura-

tion of mechanical prophylaxis in standard/high-risk patients, (v) drugs and duration of chemical prophylaxis in standard/high-risk patients, (vi) consideration of wound complications during chemical prophylaxis, (vii) postoperative screening for VTE, and (viii) relationship between administration of tranexamic acid (TXA) and occurrence of VTE (Supplementary Material 1). According to Korean Hip Society Prevention Guidelines⁵⁾, high-risk patients are defined as those with at least one of the following factors: over 60 years old, obesity (body mass index over 30 kg/m²), dehydration, one or more concomitant medical diseases (heart disease, metabolic, endocrine or respiratory disease, acute infectious disease, inflammatory disease), taking hormone therapy or contraceptives containing estrogen, currently diagnosed with cancer or undergoing treatment for cancer, critical care admission, varicose vein with phlebitis, predisposition to thrombosis, or history of VTE.

Table 1. Demographics of 97 Participants

Variable	Value
Age (yr)	
31-40	23 (23.7)
41-50	39 (40.2)
51-60	23 (23.7)
≥61	12 (12.4)
Affiliated institution (bed)	
<30	1 (1.0)
30-99	4 (4.1)
100-499	20 (20.6)
≥500	72 (74.2)
Education of residents	
Yes	84 (86.6)
No	13 (13.4)
Duration of orthopedic specialist (excluding military service) (yr)	
<10	38 (39.2)
11-20	29 (29.9)
21-30	24 (24.7)
>30	6 (6.2)
Completion of the Korean Hip Society Treatment Guideline symposium in the past three years	
Yes	77 (79.4)
No	20 (20.6)
Monthly cases of hip fracture surgery	
<5	7 (7.2)
5-10	12 (12.4)
11-20	40 (41.2)
>20	38 (39.2)

Values are presented as number (%).

RESULTS

1. Encountering VTE in the Past Year

In the past year, 61.9% of the participants had encountered at least one case of symptomatic VTE in patients with hip fractures. Regarding asymptomatic VTE, 52.6% of the participants had encountered at least one case, and 28.9% answered that they were unsure about the occurrence (Fig. 1).

2. Assessment for Screening Patients with High Risk for VTE before Surgery

Among the participants, 61.9% answered that they performed preoperative screening for risk factors for VTE, as recommended by the Korean Hip Society Prevention Guidelines⁵⁾. Among the risk factors defined in the guidelines, a history of VTE (66.0%), one or more concomitant medical conditions (42.3%), and predisposition to thrombosis (40.2%) were the most critical risk factors (Supplementary Material 2).

3. Choice of VTE Prophylaxis

In the standard-risk group, mechanical prophylaxis alone was applied by 38.1% of the participants, and dual prophylaxis in combination with chemical prophylaxis was performed by 58.8%. Dual prophylaxis was performed by 83.5% of the participants in patients with a high risk for VTE (Supplementary Material 2).

4. Device Selection and Duration of Mechanical Prophylaxis

An intermittent pneumatic compression device (IPCD) was selected as a conventional device for mechanical prophylaxis by most participants (86.6%). In standard-risk patients, mechanical prophylaxis from hospitalization to the time when patients were able to walk after surgery was applied by most participants (30.9%). In high-risk patients, mechanical prophylaxis from hospitalization to discharge was maintained by 34.0% of the participants. More surgeons recommended continuing mechanical prophylaxis after discharge for high-risk patients with poor recovery of ambulation (Supplementary Material 2).

5. Drugs and Duration of Chemical Prophylaxis, Relationship with Wound Complications

Among the participants who performed chemical prophylaxis, low molecular weight heparin (LMWH) was prescribed the most (62.9%), followed by direct oral anticoagulants (DOAC) (26.8%). More participants prescribed chemical prophylaxis for a particular period of time rather than recovery of ambulation. The period of prophylaxis varied from one to 16 weeks in standard-risk patients (mean, 4.6 weeks) and was slightly longer from two to 20 weeks (mean, 5.7 weeks) in high-risk patients. When asked about the relevance of wound complications, such as oozing and hematoma during chemical prophylaxis, the majority of participants answered that they were related and that they were attentive to wound management (73.2%) (Supplementary

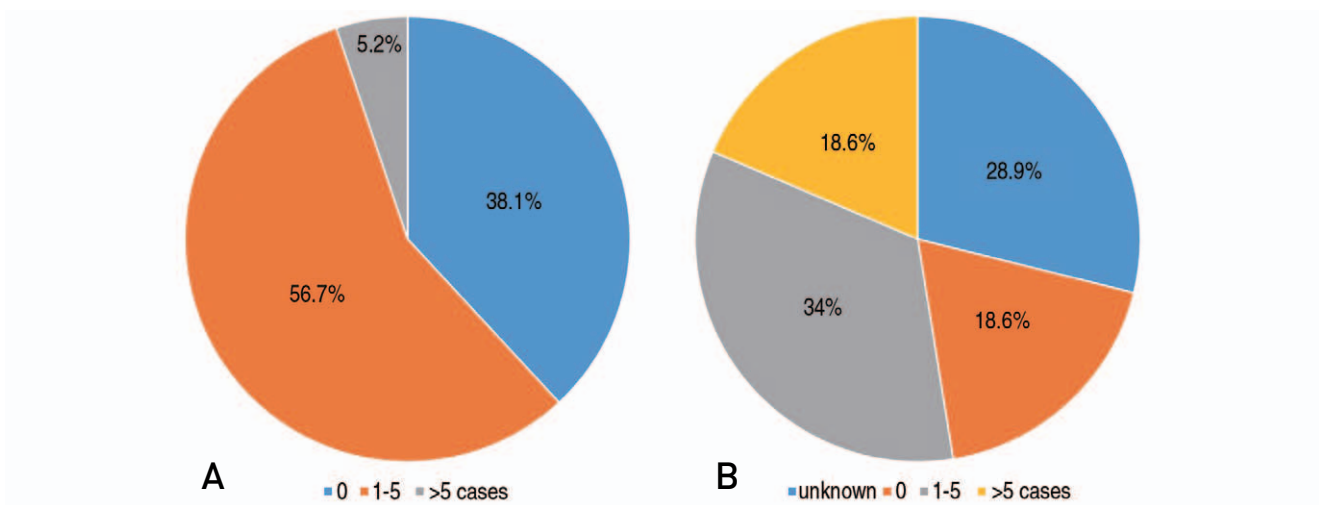


Fig. 1. Answers regarding experiences with venous thromboembolism (VTE) in patients with hip fracture during the past year. (A) Symptomatic VTE. (B) Asymptomatic VTE.

Material 2).

6. Routine Screening for Postoperative VTE

Routine screening was not performed by more than half of the participants (59.8%). Among the participants who performed routine screening for VTE after surgery, the test was performed within two weeks postoperatively by 89.7%. The D-dimer test was the most common (81.1%) as a single test item (Supplementary Material 2).

7. Association between Administration of TXA and Occurrence of VTE

When asked about the relationship between the administration of TXA and the occurrence of VTE, approximately half of the participants (49.5%) answered that either intravenous or topical use was unrelated (Supplementary Material 2).

DISCUSSION

Incidence of VTE ranging from 40% to as high as 80% has been reported in patients with hip fractures who have not received prophylaxis^{6,7}. Pulmonary embolism is a severe complication with a high mortality rate. However, application of appropriate prophylaxis could significantly reduce the incidence of VTE⁸.

With an emphasis on the high incidence of VTE, various medical societies including the American College of Chest Physicians⁹, National Institute for Health and Clinical Excellence¹⁰, and American Academy of Orthopedic Surgeons¹¹ have provided a summary of recommendations for prevention. In addition, a summary of expert opinions on the prevention of VTE was recently presented by the Asia-Pacific Region Venous Thromboembolism Consensus Group¹². In 2011, guidelines were published by the Korean Hip Society based on the situation in Korea⁵. However, most of the references included in the guidelines were over 10 years old, thus determining the current situation is difficult¹³. In addition, there is no clear consensus with regard to which prevention protocols are the safest and most effective. This diversity can present a legal argument regarding the evidence of treatment. Understanding the current status of prevention and providing recommendations that are appropriate to the domestic situation is essential. Therefore, we conducted a survey to assess the current status of VTE prevention with regard to treatment in patients with hip fractures in Korea.

VTE prophylaxis was performed by all participants in patients with hip fractures, and dual prophylaxis was applied in the high-risk group by most of them. Most guidelines recommend an appropriate combination of mechanical and chemical prophylaxis^{9,12}. An evaluation of risk factors for VTE should be performed preoperatively, and more aggressive prophylaxis is recommended for patients at high risk of VTE. Application of mechanical prophylaxis alone is recommended for patients with a high risk of bleeding^{5,12}.

A history of VTE and concomitant medical diseases were identified as important risk factors for VTE among participants in this study. A history of previous VTE, varicose veins, congestive heart failure, medical history of thromboembolic stroke, and family history of VTE were found to be risk factors associated with a significant increase in the incidence of VTE after surgery for treatment of a hip fracture¹².

According to all guidelines, mechanical prophylaxis is recommended for patients undergoing surgery for the treatment of a hip fracture unless there are contraindications. The effectiveness of mechanical prophylaxis including IPCDs, venous foot pump devices, and graduated compression stockings has been demonstrated, and using them until the patient is able to walk is recommended^{5,14}. Because preoperative VTE rates as high as 11-12% have been reported, mechanical prophylaxis should be initiated before surgery^{3,15}.

LMWH is the most commonly recommended prophylactic agent. Participants in our study also preferred LMWH and DOACs. DOACs such as apixaban, dabigatran, and rivaroxaban, which are taken orally, are easy to administer and have positive effects, and their use has shown a recent increase. Despite some differences between drugs, administration for 3-5 weeks is recommended, considering that the incidence of acute VTE may show a rapid increase up to five weeks after surgery^{9,16}. There are some concerns regarding the incidence of wound complications during chemical prophylaxis using LMWH and DOACs; care must be taken in wound management. For this reason, some studies have recommended administration of low-dose LMWH (20 mg enoxaparin once daily) only before discharge or aspirin alone^{17,18}.

Routine tests for VTE were not performed after surgery by more than half of the participants. VTE could occur even three months after surgery, therefore, the occurrence cannot be completely ruled out by routine screening during the acute phase after surgery, and problems with cost and overtreatment may arise. Therefore, routine screening before discharge is not recommended^{9,12}.

Approximately half of the participants answered that there

was no association between the administration of TXA and the occurrence of VTE. Several studies have demonstrated that the risk of VTE was not increased by administration of TXA during surgery for treatment of a hip fracture and blood loss and transfusion requirements were reduced^{19,20}.

The strength of our study is that we evaluated the current status of VTE prevention in Korea. The incidence of VTE after surgery for treatment of a hip fracture is lower in Koreans compared with Caucasians²¹. Therefore, application of foreign guidelines may result in development of issues and complications. Despite the low overall incidence of VTE in Korea, the results of this study, showing that 61.9% of the respondents had encountered a patient with symptomatic VTE at least once in the past year, suggest that prevention of VTE should never be disregarded. It may be time to update domestic guidelines according to the change in patient characteristics and treatment modalities. In a survey of members of the American Association of Hip and Knee Surgeons conducted in 2008²¹, 53% of respondents reported that they had changed their VTE treatment regimen as a result of the availability of additional guidelines and pharmacologic agents. The results of our study would be helpful in establishing updated guidelines that are suitable for Korean patients.

This study has several limitations. First, the study included a small number of participants. Because only the responses of the respondents were analyzed in our study, there may be non-response bias. In addition, because this study was conducted as a survey to identify trends among participants, the degree of choice of answers is not a criterion for use in determining whether a practice is right or wrong.

CONCLUSION

VTE prophylaxis was performed by all respondents for treatment of patients with hip fracture. Dual prophylaxis was applied by almost all participants in patients with high-risk of VTE. A routine screening test for VTE was not performed after surgery by more than half of the respondents. Wound complications require attention when prescribing chemical prophylaxis. The results of our survey provided information regarding the current status of VTE prevention for patients undergoing surgery for treatment of hip fracture in Korea and provided a baseline for establishing educational programs and guidelines in the future.

FUNDING

The authors would like to thank the Soonchunhyang

University Research Fund for their support.

ACKNOWLEDGEMENTS

This study was presented at the Fracture Symposium of the Korean Hip Society in November 2022.

CONFLICT OF INTEREST

Young-Kyun Lee has been an editorial board member since January 2023, but had no role in the decision to publish this article. No other potential conflict of interest relevant to this article was reported.

ORCID

Chang Hyun Kim (<https://orcid.org/0000-0002-2539-1058>)
 Je-Hyun Yoo (<https://orcid.org/0000-0002-0777-1575>)
 Young-Kyun Lee (<https://orcid.org/0000-0001-6564-4294>)
 Ye-Yeon Won (<https://orcid.org/0000-0002-1880-4336>)
 Jong-Seok Park (<https://orcid.org/0000-0002-0225-0500>)

SUPPLEMENTARY MATERIALS

Supplementary data is available at <https://hipandpelvis.or.kr/>.

REFERENCES

- McLaughlin MA, Orosz GM, Magaziner J, et al. *Preoperative status and risk of complications in patients with hip fracture. J Gen Intern Med.* 2006;21:219-25. <https://doi.org/10.1111/j.1525-1497.2006.00318.x>
- Yhim HY, Jang MJ, Bang SM, et al. *Incidence of venous thromboembolism following major surgery in Korea: from the Health Insurance Review and Assessment Service database. J Thromb Haemost.* 2014;12:1035-43. <https://doi.org/10.1111/jth.12611>
- Shin WC, Woo SH, Lee SJ, Lee JS, Kim C, Suh KT. *Preoperative prevalence of and risk factors for venous thromboembolism in patients with a hip fracture: an indirect multidetector CT venography study. J Bone Joint Surg Am.* 2016;98:2089-95. <https://doi.org/10.2106/JBJS.15.01329>
- Kanchanabatt B, Stapanavatr W, Meknavin S, Soorapanth C, Sumanasrethakul C, Kanchanasuttirak P. *Systematic review and meta-analysis on the rate of postoperative venous thromboembolism in orthopaedic surgery in Asian patients without thromboprophylaxis. Br J Surg.* 2011;98:1356-64. <https://doi.org/10.1002/bjs.7589>
- Park YS. *Guideline for the prophylaxis of venous thromboembolism in hip surgery patients. J Korean Orthop Assoc.* 2011;46:95-8. <https://doi.org/10.4055/jkoa.2011.46.2.95>
- Shin WC, Lee SM, Suh KT. *Recent updates of the diagnosis and prevention of venous thromboembolism in patients with a hip fracture. Hip Pelvis.* 2017;29:159-67. <https://doi.org/10.5371/hp.2017.29.3.159>

7. Geerts WH, Code KI, Jay RM, Chen E, Szalai JP. *A prospective study of venous thromboembolism after major trauma.* *N Engl J Med.* 1994;331:1601-6. <https://doi.org/10.1056/NEJM199412153312401>
8. MacDonald DRW, Neilly D, Schneider PS, et al. *Venous thromboembolism in hip fracture patients: a subanalysis of the FAITH and HEALTH trials.* *J Orthop Trauma.* 2020;34 Suppl 3:S70-5. <https://doi.org/10.1097/BOT.0000000000001939>
9. Falck-Ytter Y, Francis CW, Johanson NA, et al. *Prevention of VTE in orthopedic surgery patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines.* *Chest.* 2012;141(2 Suppl):e278S-325S. <https://doi.org/10.1378/chest.11-2404>
10. Hill J, Treasure T. *Reducing the risk of venous thromboembolism (deep vein thrombosis and pulmonary embolism) in inpatients having surgery: summary of NICE guidance.* *BMJ.* 2007;334:1053-4. <https://doi.org/10.1136/bmj.39174.678032.AD>
11. American Academy of Orthopaedic Surgeons (AAOS). *Hip fractures in older adults. Clinical practice guideline on management of hip fractures in older adults [Internet].* Rosemont: AAOS; 2021 [cited 2023 Mar 15]. Available from: https://www.orthoguidelines.org/topic?id=1038&tab=all_guidelines
12. Ngarmukos S, Kim KI, Wongsak S, et al. *Asia-Pacific venous thromboembolism consensus in knee and hip arthroplasty and hip fracture surgery: part 1. Diagnosis and risk factors.* *Knee Surg Relat Res.* 2021;33:18. <https://doi.org/10.1186/s43019-021-00099-y>
13. Muscatelli SR, Charters MA, Hallstrom BR. *Time for an update? A look at current guidelines for venous thromboembolism prophylaxis after hip and knee arthroplasty and hip fracture.* *Arthroplast Today.* 2021;10:105-7. <https://doi.org/10.1016/j.artd.2021.06.015>
14. Amarase C, Tanavalee A, Larbpaiboonpong V, et al. *Asia-Pacific venous thromboembolism consensus in knee and hip arthroplasty and hip fracture surgery: part 2. Mechanical venous thromboembolism prophylaxis.* *Knee Surg Relat Res.* 2021;33:20. <https://doi.org/10.1186/s43019-021-00101-7>
15. Girasole GJ, Cuomo F, Denton JR, O'Connor D, Ernst A. *Diagnosis of deep vein thrombosis in elderly hip-fracture patients by using the duplex scanning technique.* *Orthop Rev.* 1994;23:411-6.
16. Thiengwittayaporn S, Budhiparama N, Tanavalee C, et al. *Asia-Pacific venous thromboembolism consensus in knee and hip arthroplasty and hip fracture surgery: part 3. Pharmacological venous thromboembolism prophylaxis.* *Knee Surg Relat Res.* 2021;33:24. <https://doi.org/10.1186/s43019-021-00100-8>
17. Garfinkel JH, Gladnick BP, Roland N, Romness DW. *Increased incidence of bleeding and wound complications with Factor-Xa inhibitors after total joint arthroplasty.* *J Arthroplasty.* 2018;33:533-6. <https://doi.org/10.1016/j.arth.2017.08.039>
18. Mula V, Parikh S, Suresh S, Bottle A, Loeffler M, Alam M. *Venous thromboembolism rates after hip and knee arthroplasty and hip fractures.* *BMC Musculoskelet Disord.* 2020;21:95. <https://doi.org/10.1186/s12891-020-3100-4>
19. Xiao C, Zhang S, Long N, Yu W, Jiang Y. *Is intravenous tranexamic acid effective and safe during hip fracture surgery? An updated meta-analysis of randomized controlled trials.* *Arch Orthop Trauma Surg.* 2019;139:893-902. <https://doi.org/10.1007/s00402-019-03118-6>
20. Farrow LS, Smith TO, Ashcroft GP, Myint PK. *A systematic review of tranexamic acid in hip fracture surgery.* *Br J Clin Pharmacol.* 2016;82:1458-70. <https://doi.org/10.1111/bcp.13079>
21. Markel DC, York S, Liston MJ Jr, Flynn JC, Barnes CL, Davis CM 3rd. *Venous thromboembolism: management by American Association of Hip and Knee Surgeons.* *J Arthroplasty.* 2010;25:3-9.e1-2. <https://doi.org/10.1016/j.arth.2009.07.021>