

Thromboprophylaxis in Proximal Femur Fracture: A Pilot Survey among Practicing Orthopaedic Surgeons in India

NAYANTARA SRIKANTH¹, NAVEEN SATHIYASEELAN², JAGADEESH BHASKARAN³, S NATARAJAN⁴

ABSTRACT

Introduction: Venous Thromboembolism (VTE) and Pulmonary Embolism (PE) are more common following orthopaedic surgeries around the hip than other surgeries. However, there is still a dilemma among orthopaedic surgeons regarding whether routine thromboprophylaxis is justified in patients.

Aim: To describe current practices among orthopaedic surgeons regarding routine thromboprophylaxis among patients with proximal femur fractures.

Materials and Methods: A cross-sectional exploratory study was conducted at Department of Orthopaedics, Saveetha Medical College, Chennai, Tamil Nadu, India between March 2022 and May 2022 among orthopaedic surgeons. A Google survey form, containing 10 prevalidated multiple-choice questions, was shared on social media and medical groups. Descriptive analysis was undertaken, and statistical analysis was done with International Business Machines (IBM) Statistical Package for Social Sciences (SPSS) software version 28.0.

Results: Among the 141 respondents, 72% were from private sector institutions/hospitals. Over 90.78% of the respondents indicated that there was a role for anticoagulation therapy in proximal femur fractures, and 92% used low molecular weight heparin. The responses varied slightly depending on whether anticoagulant treatment was used preoperatively (51%) or postoperatively (48%), and if there was a waiting time of less than 24 hours to 3-5 days before surgery. Most orthopaedic surgeons opted for anticoagulation therapy in the presence of a previous history of Deep Vein Thrombosis (DVT)/PE (79%), age greater than 70 years (61%), and use of hormone replacement therapy (64%), or if the surgery lasted more than two hours (61%).

Conclusion: The present study concludes that 9.2% of orthopaedic surgeons do not use anticoagulation therapy and nearly half (48%) do not administer anticoagulation therapy preoperatively. As the proportion of elderly patients increases, consensus building will enable the formulation of practice guidelines based on evidence generated through such surveys.

Keywords: Deep vein, Embolism, Heparin, Pulmonary, Thrombosis, Venous thromboembolism

INTRODUCTION

The VTE and its complications are more common following orthopaedic surgeries around the hip than among those undergoing other surgical procedures [1]. A systematic review from India has analysed whether routine thromboprophylaxis is justified among Indian patients who sustained major orthopaedic trauma. The review identified an increase in VTE among Indian patients and indicated that lack of awareness, fear of bleeding, and the development of complications following chemical prophylaxis have raised concerns about DVT [2]. Previously, it was believed that VTE does not usually occur in Asian or Indian patients [2]. However, there is an increasing incidence of VTE, which is almost equivalent to reports from the West [3,4]. Similar reports of an increase in the incidence of VTE among Chinese and Japanese patients have also been observed [5,6].

A study of previous literature has convincingly demonstrated the necessity of thromboprophylaxis in Indian patients after trauma [7]. Several clinical trials have justified the need for thromboprophylaxis and have identified possible pharmacological agents for prophylaxis to prevent thromboembolism [8,9]. It is unclear when thromboprophylaxis should be given- preoperative, operative, or postoperative [10], since there is a high risk of postoperative thromboembolism in the elderly following a fracture of the proximal femur [11]. Additionally, there may be several risk factors for the occurrence of thromboembolism like prolonged surgery time, prolonged immobilisation, prior thromboembolism, and chronic medical conditions [12], which influence clinical decision-making. Therefore, there is a need for a standard guideline regarding the use of thromboprophylaxis after trauma.

Guidelines regarding the use of thromboprophylaxis in trauma exist in countries such as the United States and United Kingdom [12-14], but such guidelines are yet to be formulated in India. An increase in VTE among Indian patients has been observed recently [2]. Hence, there is an urgent need to develop a consensus in clinical practice to determine the optimal timing, duration, choice of drug, factors that would prompt the use of anticoagulants, and factors that would limit their use. For example, it is perceived that preoperative anticoagulation therapy may increase the risk of postoperative intraspinal haematoma.

Surveys were undertaken among orthopaedic surgeons in New Zealand and Australia [15,16] to document their views and clinical expertise, which led to the development of guidelines and informed clinical practice. VTE, especially asymptomatic cases, have been documented to occur in 50% of those with hip injuries, of which 10% developed fatal PE [17-20]. Asymptomatic thrombi are more common than symptomatic cases [17,21,22]. The rate of occurrence of symptomatic VTE ranges from 1.3% to 6% [23-25]. In proximal femur fractures, the rate of VTE is 40% [26].

To the authors knowledge, no such surveys have been conducted among orthopaedic surgeons in India. This study was undertaken to conduct a survey among orthopaedic surgeons on different aspects of existing practices regarding thromboprophylaxis in proximal femur fractures.

MATERIALS AND METHODS

A cross-sectional exploratory study was conducted at Department of Orthopaedics Saveetha Medical College and Hospital, Chennai, Tamil Nadu, India between March 2022 and May 2022, after obtaining Institutional Ethics Committee approval (015/02/2022/IEC/SMCH).

Sample size calculation: The sample size of 141 was calculated based on the formula: $n = \{z^2 \cdot p \cdot (1-p) / e^2\} / \{1 + (z^2 \cdot p \cdot (1-p) / (e^2 \cdot N))\}$, provided by the statistician. Where: $z=1.96$ for a confidence level (α) of 95%, p =proportion (expressed as a decimal), N =population size, e =margin of error. To account for attrition, the sample size was increased, and the survey was sent to 200 orthopaedic surgeons.

Inclusion criteria: All practicing orthopaedic surgeons who were willing to participate in the study and submit the survey were included.

Exclusion criteria: Non-practicing orthopaedic surgeons or practicing orthopaedic surgeons who were unwilling to participate in the study were excluded.

Study Procedure

A questionnaire was sent in the form of a Google survey, and a few hard copies were given to those who preferred it. The questionnaire was prevalidated by a few orthopaedic surgeons contacted through the orthopaedic association at a conference.

The Google survey form consisted of ten questions, with formats including yes or no responses or multiple-choice responses. Questions 7 and 8 included rating the response as "most likely" or "least likely". The Google survey form was sent through social media platforms such as WhatsApp. The questionnaire was in English. Only one question related to demographic details. The practicing orthopaedic surgeons were surveyed as a whole, and there was no comparator group. The survey was conducted by posting the survey link in social media groups. Reminders to participate and complete the survey were sent through messages or phone calls.

STATISTICAL ANALYSIS

Data analysis was done using Microsoft excel. Descriptive frequency analysis was performed to determine the proportion of orthopaedic surgeons who described the role of anticoagulation therapy across government and private sector teaching and non teaching hospitals, as well as private clinics. Frequency analysis of the responses was considered the most appropriate method for statistical analysis, and it was done using IBM SPSS software version 28.0.

RESULTS

Among the 200 orthopaedic surgeons to whom the survey form was sent, 141 responded. The distribution of years of experience was as follows [Table/Fig-1].

| Years | No. of surgeons | Percentage |
|-------------|-----------------|------------|
| <5 years | 53 | 37.58% |
| 5-10 years | 28 | 19.85% |
| 10-20 years | 36 | 25.53% |
| >20 years | 24 | 17% |

[Table/Fig-1]: Incidence of years of experience.

Out of the 141 surgeons, 46.09% were from private sector teaching hospitals. The distribution of practicing locations was as follows [Table/Fig-2].

| Location | No. of surgeons | Percentage |
|---|-----------------|------------|
| Government sector- teaching hospital | 24 | 17.02% |
| Government sector- non teaching hospital | 6 | 4.25% |
| Private sector- teaching hospital | 65 | 46.09% |
| Private sector- corporate (non teaching hospital) | 37 | 26.24% |
| Others | 9 | 6.38% |

[Table/Fig-2]: Incidence of practising location.

Of the 141 orthopaedic surgeons who participated, 128 (90.78%) responded that there was a role for anticoagulation therapy, while 13 (9.2%) did not believe there was a role for anticoagulation therapy in fractures of the proximal femur [Table/Fig-3].

| Question numbers | Variables | Number respondents (n=141) and percentage of responses |
|------------------|--|--|
| Q2 | Role of anticoagulant therapy | |
| | Yes | 128 (90.78%) |
| | No | 13 (9.2%) |
| Q3 | Time to surgery or waiting period | |
| | <24 hours | 25 (17%) |
| | 1-3 days | 74 (52%) |
| | 3-5 days | 10 (7%) |
| | >5 days | 32 (22%) |
| Q4 | Timing of administration of anticoagulant | |
| | Before surgery | 73 (51.7%) |
| | During surgery | Nil |
| | After surgery | 68 (48%) |
| Q5 | Type of drug | |
| | Standard heparin | 4 (2.9%) |
| | Low molecular weight heparin | 130 (92%) |
| | Oral anticoagulant (e.g., Dabigatran) | 7 (4.9%) |

[Table/Fig-3]: Analysis of the responses on role, drug and timing of administration of anticoagulant therapy.

In response to the question on which drug is usually used for anticoagulation in patients with fractures of the proximal femur, over 92% of the respondents chose low molecular weight heparin. Only 5% chose oral anticoagulants such as dabigatran, and an even smaller percentage (2.9%) used standard heparin [Table/Fig-3].

Regarding when the anticoagulant should be started, it appeared that almost half of the respondents preferred using it preoperatively, while the rest preferred postoperative initiation. Only 18.4% felt that anticoagulant therapy should be stopped 24 hours before surgery [Table/Fig-4].

| Q6. How many hours before surgery will you stop anticoagulants? | 12 hours before surgery | 24 hours before surgery | 6 hours before surgery | Will not start anticoagulants before surgery |
|---|-------------------------|-------------------------|------------------------|--|
| Response | 65 | 26 | 10 | 40 |

[Table/Fig-4]: Analysis of the responses regarding the hours before surgery will you stop anticoagulants.

Among the respondents, 52% indicated that the maximum time to surgery was up to three days, with 17% performing surgery within 24 hours [Table/Fig-3]. There are higher rates of mortality and reduction in quality of life associated with hip fractures. Current guidelines recommend surgery for hip fractures to be performed within 24 hours, as a reduction in waiting time is associated with improved functional outcomes and reduced perioperative complications [25]. However, there are surgeons who advocate for waiting and prefer delaying surgery beyond current guidelines, as they believe this will medically optimise patients and decrease perioperative risks and complications.

In the present study, 73 (52%) of surgeons wanted to wait between one and three days, while only 24 (17%) of surgeons waited for a period of less than 24 hours according to current guidelines. About 10 (7%) of surgeons waited between three and five days. The reasons for waiting may include preoperative patient workup, especially in older patients, evaluation of cardiac status, financial constraints of the patient, and obtaining consent.

Patient factors that may influence clinical decision-making in opting for anticoagulation therapy included obesity, diabetes, smoking, previous history of DVT or PE, general anaesthesia, surgery lasting more than two hours, age less than 70 years, age over 70 years, patients on hormone replacement therapy, preoperative ulceration, and previous thrombophlebitis [Table/Fig-5,6].

| Q7. Which of the following conditions in your opinion would increase the likelihood of opting for anticoagulation? | Most likely (%) | Least likely (%) |
|--|-----------------|------------------|
| Active malignancy | 93 (66) | 48 (34) |
| Current smoker | 106 (75.1) | 35 (24.8) |
| Obesity | 127 (90) | 14 (9.9) |
| Previous DVT/PE | 139 (98.5) | 2 (1.4) |
| Diabetes | 75 (53.1) | 66 (46.8) |
| General anaesthesia | 37 (26.2) | 104 (73.7) |
| Surgery of more than 2 hour duration | 87 (61.7) | 54 (38.2) |
| Age less than 70 years | 31 (22) | 110 (78) |
| Age more than or equal to 70 years | 118 (83.6) | 23 (19.8) |
| Patient on hormone replacement therapy | 88 (62.4) | 53 (37.5) |
| Preoperative ulceration | 27 (19.1) | 114 (80.8) |
| Previous thrombophlebitis | 110 (78) | 31 (21.9) |

[Table/Fig-5]: Analysis of the responses regarding the conditions which in your opinion would increase the likelihood of opting for anticoagulation.

| Q8. Which of the following conditions in your opinion would decrease the likelihood of opting for anticoagulation? | Most likely (%) | Least likely (%) |
|--|-----------------|------------------|
| Active peptic ulcer | 94 (66.6) | 47 (33.3) |
| Major bleeding diathesis | 123 (87.2) | 18 (12.7) |
| Age less than 70 years | 75 (53.1) | 66 (46.8) |
| Age more than or equal to 70 years | 37 (26.2) | 104 (73.7) |

[Table/Fig-6]: Analysis of the responses regarding the conditions in your opinion would decrease the likelihood of opting for anticoagulation.

Most orthopaedic surgeons opted for anticoagulation therapy in the presence of a previous history of DVT or PE (98.5%), age greater than 70 years (83.6%), and the use of hormone replacement therapy (62.4%). Surgery lasting more than two hours (61.7%) was also considered a factor for anticoagulation therapy [Table/Fig-5]. Among all factors, age less than 70 years was considered the least likely reason to prescribe anticoagulation therapy by 78% of the respondents.

Limited use of anticoagulation therapy was attributed to reasons such as expense and inconvenience, as well as the belief that mechanical methods are not inferior. As mentioned earlier, only 6.3% of orthopaedic surgeons who responded do not use anticoagulation therapy, which may be due to the expense or preference for mechanical methods [Table/Fig-7].

| Q9. Is your use of chemoprophylaxis limited because you believe that it is* | Yes | No |
|---|-----|----|
| Not safe as it causes too much bleeding | 23 | 87 |
| Not superior to mechanical methods | 23 | 85 |
| Unnecessary because the risk of thromboembolism is low | 34 | 76 |
| Not effective in preventing thromboembolism | 15 | 95 |
| Too expensive | 37 | 75 |
| Too inconvenient to administer and monitor | 18 | 92 |
| Others | 12 | 59 |
| I regularly use hence not applicable | 72 | 44 |

[Table/Fig-7]: Analysis of the responses regarding the use of chemoprophylaxis.
*Some participants did not respond

While several orthopaedic surgeons reported no complications, some encountered complications. The most frequently encountered complication was bleeding (40%), which included soaking of the dressing or bleeding in the gastrointestinal tract. Thrombocytopenia following treatment with heparin was also documented [Table/Fig-8].

In response to the question, "What complications have you faced due to the use of anticoagulants in patients with fractures of the proximal femur?", there were various responses. These included "I had problems with oral anticoagulants"; "I have not had any

| Q10. Sampling of the responses received to what complications have you faced because of the use of anticoagulants in patients with fracture of proximal femur? |
|--|
| "Epidural haematoma" |
| "Bleeding in the operative wound" |
| "Increase in intracompartmental bleeding" |
| "None" |
| "Thromboembolism" |
| "Bleeding, melena" |
| "None so far" |
| "Nothing major except slightly increased drainage" |
| "Excessive wound soakage in immediate postop period" |
| "Ecchymosis" |
| "Wound soakage, increased drain output" |
| "So far APD only (use aspirin on outpatient basis)" |

[Table/Fig-8]: Analysis of the responses regarding the complications faced because of the use of anticoagulants in patients with fracture of proximal femur.

problems with fractures of the proximal femur with anticoagulants, but patients without anticoagulants have developed DVT and PE"; "Allergic reaction, Intracranial Haemorrhage (ICH), worsening of renal parameters in CKD patients, and all these complications mentioned are rarely seen by me"; "Anticoagulants are mostly used in elderly patients who are more likely to be bedridden for a long time postsurgery or were less active even prior to surgery."

DISCUSSION

The study aimed to capture the practices and preferences of orthopaedics regarding the use of thromboprophylactic agents to prevent DVT or pulmonary venous thrombosis among patients with fractures of the proximal femur. The majority of the respondents were from the private sector. Most respondents (90.78%) preferred to use anticoagulation therapy, primarily low molecular weight heparin. There was a clear difference in opinion on the timing of when to initiate anticoagulation therapy, with a little over 50% preferring preoperative initiation and the rest preferring postoperative initiation.

Several patient factors, such as previous DVT, age, and prolonged surgery, may contribute to the decision to use anticoagulation therapy. As previously stated, there are guidelines in countries such as the UK, Australia, and New Zealand [15,16]. There is an urgent need to develop guidelines in India. This pilot study provides baseline data on clear preferences and contentious views among practicing orthopaedics and provides direction for planning a larger study to build consensus on anticoagulation therapy for fractures of the proximal femur. As patient factors and co-morbid conditions that govern practices are largely based on Western data, it may be worthwhile to conduct randomised clinical trials to generate relevant data for practicing orthopaedics in India.

Sevitt S and Gallagher NG, in a landmark study in 1959, demonstrated the beneficial effects of thromboprophylaxis in hip injuries and its considerable reduction in mortality [24]. However, there are some orthopaedic surgeons who believe that since patients with hip injuries are elderly and have co-morbidities that contribute to mortality, there may be no benefit in thromboprophylaxis and there may also be a risk of bleeding complications. This dilemma has led to the conduct of several surveys in the UK and other countries [15,16].

The dilemma of using thromboprophylactic agents in fractures of the proximal femur requires tapping into the clinical expertise of orthopaedic surgeons to assist in building consensus and subsequently developing guidelines for clinical practice [25]. In view of the pandemic situation and the need to reach out to many orthopaedic surgeons, the Google survey format was used to capture responses. Some responses have shown very clear preferences for the use of specific drugs for thromboprophylactic therapy. Over 92% of the respondents preferred low molecular

weight heparin, which may be due to its greater bioavailability, lower incidence of thrombocytopenia, longer half-life, and greater efficacy. Previous studies in Australia and New Zealand [16,27,28] documented the use of dextran, warfarin, and standard heparin, however, these studies were conducted much earlier.

It is also documented that delay in surgical intervention may increase the risk of preoperative DVT. There is a lack of consensus on when anticoagulation therapy should be initiated for appropriate antithrombotic effectiveness. However, it has been documented that anticoagulation therapy initiated 12 hours prior to surgery was effective [26]. Delay in surgery itself is a major risk factor for the development of thrombosis. Other studies have also reported such an association [25]. In a previous study, among patients who had a delay of 48 hours or more, 61% had evidence of thromboembolism in the injured limb [26]. The resolution of this dissension is not feasible as most studies that focus on the issue of waiting period in surgery are observational studies [25]. The issue of surgical waiting period continues to remain a controversial issue and warrants experimental studies (such as randomised trials) to focus on this issue and offer insight into the effects of surgical waiting times on health outcomes.

Limitation(s)

This is the first study undertaken in India among orthopaedic surgeons to determine the role of anticoagulation therapy in fractures of the proximal femur. This is a pilot exploratory study, and larger studies with a larger sample size may be undertaken to ascertain the role of anticoagulation therapy in other orthopaedic injuries. In the present study, demographic data like, age and sex of the surgeons were not included.

CONCLUSION(S)

The present study documents the factors that guide clinical decision-making among orthopaedic surgeons in opting for anticoagulation therapy, the current practices among orthopaedic surgeons regarding the choice and timing of therapy, and the patient factors that are most likely and least likely to lead to the initiation of anticoagulation therapy. As the proportion of elderly individuals increases in India, consensus building will enable the formulation of practice guidelines using evidence generated through such surveys.

The present preliminary survey clearly indicates that orthopaedic surgeons do believe in the need for anticoagulation therapy in hip injuries. However, there are differences of opinion regarding the timing and duration of therapy. There is very little difference of opinion on the choice of anticoagulant therapy.

Acknowledgement

The authors gratefully acknowledge the assistance provided by the heads of Departments of Orthopaedics of teaching hospitals/medical institutions to facilitate the conduct of the survey. The authors also thank each respondent from the private and government sectors for devoting their precious time to answering the questionnaire, without which the present study could not have been conducted.

REFERENCES

- [1] Flevas DA, Megaloiakonimos PD, Dimopoulos L, Mitsiokapa E, Koulouvaris P, Mavrogenis AF. Thromboembolism prophylaxis in orthopaedics: An update. *EFORT Open Rev* [Internet]. 2018;3(4):136-48. Available from: <http://dx.doi.org/10.1302/2058-5241.3.170018>.
- [2] Kamerkar DR, John MJ, Desai SC, Dsilva LC, Joglekar SJ. Arrive: A retrospective registry of Indian patients with venous thromboembolism. *Indian J Crit Care Med* [Internet]. 2016;20(3):150-58. Available from: <http://dx.doi.org/10.4103/0972-5229.178178>.
- [3] Agarwal S, Lee AD, Raju RS, Stephen E. Venous thromboembolism: A problem in the Indian/Asian population? *Indian J Urol* [Internet]. 2009;25(1):11-16. Available from: <http://dx.doi.org/10.4103/0970-1591.45531>.
- [4] Wang KL, Yap ES, Goto S, Zhang S, Siu CW, Chiang CE. The diagnosis and treatment of venous thromboembolism in Asian patients. *Thromb J* [Internet]. 2018;16(1):4. Available from: <http://dx.doi.org/10.1186/s12959-017-0155-z>.
- [5] Wang H, Ye J, Wang L, Jin W. Risk characteristics of venous thromboembolism in Chinese patients. *Clin Appl Thromb Hemost* [Internet]. 2016;22(5):490-94. Available from: <http://dx.doi.org/10.1177/1076029615569272>.
- [6] Lee LH, Gallus A, Jindal R, Wang C, Wu CC. Incidence of venous thromboembolism in Asian populations: A systematic review. *Thromb Haemost* [Internet]. 2017;117(12):2243-60. Available from: <http://dx.doi.org/10.1160/TH17-02-0134>.
- [7] Sen RK, Tripathy SK, Singh AK. Is routine thromboprophylaxis justified among Indian patients sustaining major orthopaedic trauma? A systematic review. *Indian J Orthop* [Internet]. 2011;45(3):197-207. Available from: <http://dx.doi.org/10.4103/0019-5413.80037>.
- [8] Palmer AJ, Koppenhagen K, Kirchof B, Weber U, Bergemann R. Efficacy and safety of low molecular weight heparin, unfractionated heparin and warfarin for thrombo-embolism prophylaxis in orthopaedic surgery: a meta-analysis of randomised clinical trials. *Haemostasis* [Internet]. 1997;27(2):75-84. Available from: <http://dx.doi.org/10.1159/000217437>.
- [9] Handoll HH, Farrar MJ, McBirnie J, Tytherleigh-Strong G, Milne AA, Gillespie WJ. Heparin, low molecular weight heparin and physical methods for preventing deep vein thrombosis and pulmonary embolism following surgery for hip fractures. *Cochrane Database Syst Rev* [Internet]. 2002;(4):CD000305. Available from: <http://dx.doi.org/10.1002/14651858.CD000305>.
- [10] Strebel N, Prins M, Agnelli G, Büller HR. Preoperative or postoperative start of prophylaxis for venous thromboembolism with low-molecular-weight heparin in elective hip surgery? *Arch Intern Med* [Internet]. 2002;162(13):1451-56. Available from: <http://dx.doi.org/10.1001/archinte.162.13.1451>.
- [11] Niu S, Li J, Zhao Y, Ding D, Jiang G, Song Z. Preoperative deep venous thrombosis (DVT) after femoral neck fracture in the elderly, the incidence, timing, location and related risk factors. *BMC Musculoskelet Disord* [Internet]. 2021;22(1):264. Available from: <http://dx.doi.org/10.1186/s12891-021-04145-4>.
- [12] McLendon K, Goyal A, Attia M. Deep venous thrombosis risk factors. *StatPearls Publishing*; 2023.
- [13] Ortel TL, Neumann I, Ageno W, Beyth R, Clark NP, Cuker A, et al. American Society of Hematology 2020 guidelines for management of venous thromboembolism: treatment of deep vein thrombosis and pulmonary embolism. *Blood Adv* [Internet]. 2020;4(19):4693-738. Available from: <http://dx.doi.org/10.1182/bloodadvances.2020001830>.
- [14] 733fm.6 thromboprophylaxis in the hospital setting: Reducing the risk of hospital acquired deep vein thrombosis or pulmonary embolism [Internet]. Nhs.uk. [cited 2023 Jun 3]. Available from: http://www.bucksformulary.nhs.uk/docs/Guideline_733FM.pdf.
- [15] Perioperative anticoagulation management [Internet]. Medscape.com. 2022 [cited 2023 Jun 3]. Available from: <https://emedicine.medscape.com/article/285265-overview>.
- [16] Tran HA, Gibbs H, Merriman E, Curnow JL, Young L, Bennett A, et al. New guidelines from the Thrombosis and Haemostasis Society of Australia and New Zealand for the diagnosis and management of venous thromboembolism. *Med J Aust* [Internet]. 2019;210(5):227-35. Available from: <http://dx.doi.org/10.5694/mja2.50004>.
- [17] Lieberman JR, Bell JA. Venous thromboembolic prophylaxis after total hip and knee arthroplasty. *J Bone Joint Surg Am* [Internet]. 2021;103(16):1556-64. Available from: <http://dx.doi.org/10.2106/JBJS.20.02250>.
- [18] MacDonald DRW, Min JK, Schneider PS, Bzovsky S, Sprague S, Axelrod D, et al. Venous thromboembolism in hip fracture patients: A subanalysis of the FAITH and HEALTH trials. *J Orthop Trauma* [Internet]. 2020;34(Suppl 3(3)):S70-75. Available from: <http://dx.doi.org/10.1097/BOT.0000000000001939>.
- [19] Sloan M, Sheth N, Lee GC. Is obesity associated with increased risk of deep vein thrombosis or pulmonary embolism after hip and knee arthroplasty? A large database study. *Clin Orthop Relat Res* [Internet]. 2019;477(3):523-32. Available from: <http://dx.doi.org/10.1097/CORR.0000000000000615>.
- [20] Cai YJ, Cui CM, Min JK, Cao YQ, Zhang LY. Comparison between use of direct oral anticoagulants and aspirin for risk of thromboembolism complications in patients undergoing total knee and hip arthroplasty: A systematic review and meta-analysis. *Eur Rev Med Pharmacol Sci* [Internet]. 2021;25(20):6245-59. Available from: http://dx.doi.org/10.26355/eurev_202110_26994.
- [21] Major Extremity Trauma Research Consortium (METRC); O'Toole RV, Stein DM, O'Hara NN, Frey KP, Taylor TJ, et al. Aspirin or low-molecular-weight heparin for thromboprophylaxis after a fracture. *N Engl J Med* [Internet]. 2023;388(3):203-13. Available from: <http://dx.doi.org/10.1056/nejmoa2205973>.
- [22] Mihara M, Tamaki Y, Nakura N, Takayanagi S, Saito A, Ochiai S, et al. Clinical efficacy of risk-stratified prophylaxis with low-dose aspirin for the management of symptomatic venous thromboembolism after total hip arthroplasty. *J Orthop Sci* [Internet]. 2020;25(1):156-60. Available from: <http://dx.doi.org/10.1016/j.jos.2019.02.009>.
- [23] Matthay ZA, Flanagan CP, Sanders K, Smith EJ, Lancaster EM, Gasper WJ, et al. Risk factors for venous thromboembolism after vascular surgery and implications for chemoprophylaxis strategies. *J Vasc Surg Venous Lymphat Disord* [Internet]. 2022;10(3):585-93.e2. Available from: <http://dx.doi.org/10.1016/j.jvs.2021.10.001>.
- [24] Sevitt S, Gallagher NG. Prevention of venous thrombosis and pulmonary embolism in injured patients. *Lancet* [Internet]. 1959;274(7110):981-89. Available from: [http://dx.doi.org/10.1016/s0140-6736\(59\)91464-3](http://dx.doi.org/10.1016/s0140-6736(59)91464-3).
- [25] Morris GK, Mitchell JRA. Prevention and diagnosis of venous thrombosis in patients with hip fractures. *Lancet* [Internet]. 1976;308(7991):867-69. Available from: [http://dx.doi.org/10.1016/s0140-6736\(76\)90535-3](http://dx.doi.org/10.1016/s0140-6736(76)90535-3).
- [26] Falck-Ytter Y, Francis CW, Johanson NA, Curley C, Dahl OE, Schulman S, et al. Prevention of VTE in orthopaedic surgery patients. *Chest* [Internet]. 2012;141(2):e278S-e325S. Available from: <http://dx.doi.org/10.1378/chest.11-2404>.

- [27] Junqueira DR, Zorzela LM, Perini E. Unfractionated heparin versus low molecular weight heparins for avoiding heparin-induced thrombocytopenia in postoperative patients. *Cochrane Database Syst Rev* [Internet]. 2017;4(4):CD007557. Available from: <http://dx.doi.org/10.1002/14651858.CD007557.pub3>.
- [28] Turhan S, Karaarslan K, Abud B. The usage and outcomes of dextran in the treatment of acute deep venous thrombosis. *Vascular* [Internet]. 2023;31(2):298-303. Available from: <http://dx.doi.org/10.1177/170853812111067039>.

PARTICULARS OF CONTRIBUTORS:

1. Undergraduate Student, Department of Orthopaedics, Saveetha Medical College, Saveetha Institute of Medical Sciences, Chennai, Tamil Nadu, India.
2. Assistant Professor, Department of Orthopaedics, Saveetha Medical College, Saveetha Institute of Medical Sciences, Chennai, Tamil Nadu, India.
3. Assistant Professor, Department of Orthopaedics, Saveetha Medical College, Saveetha Institute of Medical Sciences, Chennai, Tamil Nadu, India.
4. Senior Professor and Head, Department of Orthopaedics, Saveetha Medical College, Saveetha Institute of Medical Sciences, Chennai, Tamil Nadu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Jagadeesh Bhaskaran,
Assistant Professor, Department of Orthopaedics, Saveetha Medical College,
Saveetha Institute of Medical Sciences, Thandalam,
Chennai-602105, Tamil Nadu, India.
E-mail: jakku158@outlook.com

PLAGIARISM CHECKING METHODS: [\[Jain H et al.\]](#)

- Plagiarism X-checker: Dec 30, 2022
- Manual Googling: Feb 16, 2023
- iThenticate Software: Jun 19, 2023 (5%)

ETYMOLOGY: Author Origin**EMENDATIONS:** 9**AUTHOR DECLARATION:**

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Dec 23, 2022**Date of Peer Review: **Feb 10, 2023**Date of Acceptance: **Jul 21, 2023**Date of Publishing: **Sep 01, 2023**