

Research Article

Current Trends Regarding Perioperative Pharmacological Anticoagulation in Lower Limb Surgeries among Orthopedic Surgeons of Pakistan -An Audit

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Abstract: Perioperative anticoagulation has been recommended by AAOS, AACP, and ASH during orthopedic procedures of the lower limb. Guidelines show a difference of opinion regarding the optimum duration and drug of choice giving a way to use different methods of anticoagulation. This audit assessed the preferences for pharmacological anticoagulation in lower limb surgeries among orthopedic surgeons of Pakistan.

Materials and Methods: An online questionnaire-based cross-sectional study was started from June-September 2021 in Dr Ruth K.M. Pfau Civil Hospital Karachi where Orthopedic surgeons (n=632) were invited to fill those questionnaires. A total of 85 orthopedic surgeons responded completely. An electronic eight-question survey was designed which included questions about demographics of surgeons, the drug of choice, perioperative duration, preferred surgeries, and average incidence of thromboembolism per year.

Results: 12.9% surgeons use anticoagulation for all surgeries while 82.3% of orthopedic surgeons use anticoagulants in selective surgeries. LMWH (94.1%) and Rivaroxaban (17.6%) were the drug of choice for most surgeons. 70.6% of respondents never used anticoagulation preoperatively. 17.7% used it three days preoperatively. 28.24% of surgeons prescribed anticoagulation for 3 days postoperatively while 17.7% of surgeons prescribed anticoagulation for 2 weeks postoperatively. 10.6% of surgeons never used anticoagulation postoperatively. Arthroplasty (71.7%), trauma (55.3%), and pelvis and acetabulum (54.1%) were the subspecialties with routine anticoagulation. 81.2% and 17.7% of surgeons reported less than 1% and 1% to 3% incidence of thromboembolism, respectively. No surgeon reported any incidence of thromboembolism above 5%.

Conclusion: Use of anticoagulation is prevalent among orthopedic surgeons in Pakistan. However, significant differences are observed regarding the perioperative duration. The surgeons need to prescribe DOAC such as Rivaroxaban and Dabigatran as agents of choice while extended postoperative pharmacological anticoagulation of 28-35 days needs to be adopted.

Keywords: Anticoagulation, Orthopedic surgery, Preventive medicine, Thromboembolism, Lower limb, Pulmonary embolism.

INTRODUCTION

Venous Thromboembolism (VTE) can be Deep Vein Thrombosis (DVT), Pulmonary Embolism (PE), or both. The estimated incident rate of VTE remains 1-2 per 1000 [1]. Prevalence of VTE is greater in Western countries than Asian countries but have augmented with time [2]. VTE is preferentially common in lower limb surgeries than in the upper limb [3]. It is the most feared and dreadful complication of lower limb surgeries which if left unaddressed can give rise to life-threatening pulmonary embolism. Acquired conditions such as malignancy, infection, inflammatory diseases, pregnancy, immobilization, and diabetes increase the risk of VTE postoperatively in lower limb surgeries. The most common presentation of lower limb VTE is swelling (seen in

70% of patients) followed by pain (seen in 50% of patients) and redness [4]. Mostly, events of VTE occur within 30 days postoperatively in all types of orthopedic surgical procedures [5]. Pre-test probability using Well's criteria along with D-dimer is the predictive modality for VTE [6].

The use of VTE prophylaxis in all major orthopedic surgeries is the norm in western countries, where the guideline including the American Society of Hematology (ASH), American College of Chest Physicians (ACCP), American Academy of Orthopedic Surgeons (AAOS), National Institute for Health and Care Excellence (NICE) have recommended the use of prophylaxis preoperatively [7-9]. But most guidelines hold a difference of opinion regarding the optimum duration and drug of choice. However, the guidelines have defined the least and maximum possible durations while the optimum duration

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remains yet unclear thereby paving a way for the clinicians to opt for different anticoagulation. The variability in the practice of VTE prophylaxis may lead to benefits as well as poor outcomes with differences in success and failures from one surgeon to another.

Hence the prophylaxis against VTE is of utmost importance and highly recommended in various studies [10]. This study aims to assess the orthopedic surgeons for their preference for pharmacological anticoagulation in lower limb surgeries whereby observing the current trends regarding duration and the incidences of VTE faced by them. The results may also represent the most suitable and convenient anticoagulation regimen for clinical use by considering the incidences of VTE, choice of drug, and duration reported by different surgeons.

MATERIALS AND METHODS

A cross-sectional study was designed by the authors. The population under consideration for this survey was Orthopaedic surgeons of Pakistan. The request to participate was sent to 632 orthopedic surgeons of which 85 responded. Consents were obtained in the first part age of the questionnaire where anonymity was confirmed to all participants.

The inclusion of participants was based on being clinically practicing orthopedic surgeons who have not been out of practice for more than a year. The participant were scrutinized for registration in Pakistan Orthopedic Association. Surgeons were excluded from study if they were retired or not practicing clinically. Academic surgeons and community surgeons who were no longer practicing for a year were also excluded. Incomplete forms and consents were excluded.

The data collection started from June-September 2021 with a total duration of 4 months. We designed a tool for this survey which was an online questionnaire consisting of eight self-generated close-ended questions. Survey Monkey app was used for dissemination of online survey sent through social media accounts and e-mails with two reminders one week apart.

We divided our questionnaire into three sections. In the first section, two questions were asked related to the basic information of respondents i.e., designation of surgeon and numbers of years in practice. In the second section, three questions were asked regarding the preferred anticoagulants for VTE in orthopedic surgeries and its administration duration before and after surgery. In the third section, two questions were asked regarding the average incidence of thromboembolism faced yearly and the type of surgery in which they considered anticoagulants. All the questions were multiple choice questions except the questions of characteristics of the responding surgeon mentioned in Table 1 where

answers were single choice answers.

STATISTICAL ANALYSIS

After response collection, organizing, coding, and tabulating were performed in SPSS version 22 (IBM Corp. Armonk, NY) and Microsoft Office Excel. The statistical analyses included descriptive statistics.

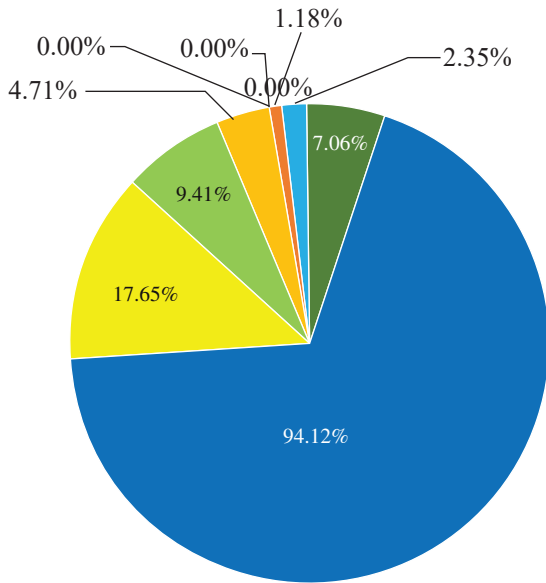
RESULTS

85 (13.45%) orthopedic surgeons responded out of 632 surgeons who were invited. The respondents included 31 (36.47%) consultants or senior registrars, 34 (40%) Assistant Professors, 8 (9.41%) Associate Professors, and 12 (14.21%) Professors. We also evaluated the years of experience where respondents reported that 14 (16.47%) had more than 20 years of experience and 21 (24.71%) had less than five years of experience. 10 (11.76%) surgeons were performing five surgeries per day while 21 (24.71%) were performing 5-10 surgeries per day. 54 (63.53%) of the respondents were performing more than 10 surgeries per day. 31 (36.47%) and 54 (63.53%) of the respondents were working on the secondary and tertiary levels of the healthcare system, respectively. The data are summarized in Table 1.

Table 1. Characteristics of the Participants Responding to the Survey.

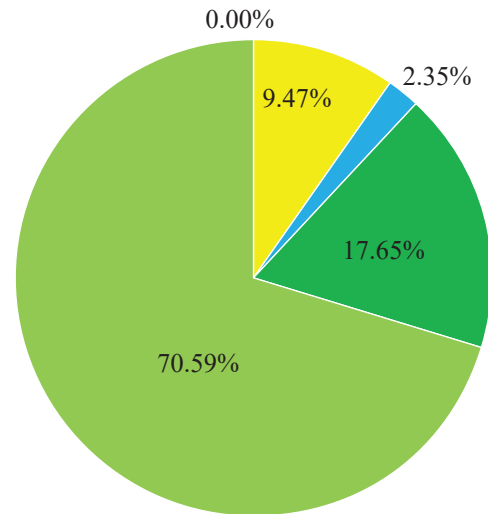
| Characteristics | n (%) |
|---------------------------------------|-------------|
| Designations | |
| Consultants | 31 (36.47%) |
| Assistant Professor | 34 (40%) |
| Associate Professor | 8 (9.41%) |
| Professor | 12 (14.12%) |
| Duration of practice | |
| Less than 5 years | 21 (24.71%) |
| 5 to 10 years | 27 (31.76%) |
| 10 to 20 years | 23 (27.06%) |
| More than 20 years | 14 (16.47%) |
| Level of the healthcare system | |
| Secondary healthcare system | 31 (36.47%) |
| Tertiary healthcare system | 54 (63.53%) |
| Surgeries performed per week | |
| Less than 5 | 10 (11.76%) |
| 5-10 | 21 (24.71%) |
| More than 10 | 54 (63.53%) |

LMWH turned out to be the most used drug by 80 (94.12%) of the respondents. Other drugs that were being used included Rivaroxaban by 15 (17.65%), Warfarin by 8 (9.41%), and Unfractionated Heparin by 6 (7.06%) of the total participants (Fig. 1).



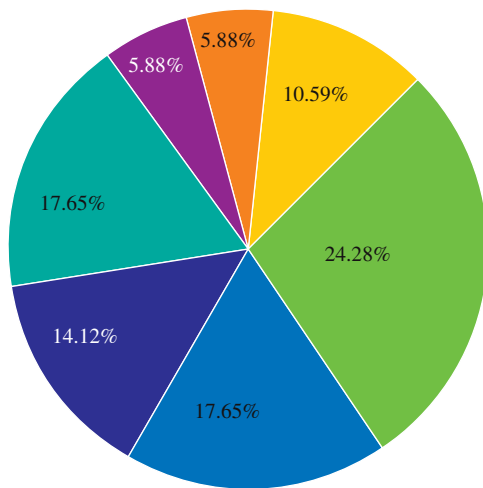
■ Unfractionates Heparin ■ Low Molecular Weight Heparin
 ■ Rivaroxaban ■ Warfarin ■ Fondaparinux ■ Apixaban
 ■ Argatroban ■ Dabigatran ■ Bivalirudin ■ Daltaperin

Fig. (1). Pie Chart showing the Anticoagulant Drugs chosen by Orthopaedic Surgeons for the use of Pharmacological Anticoagulation.



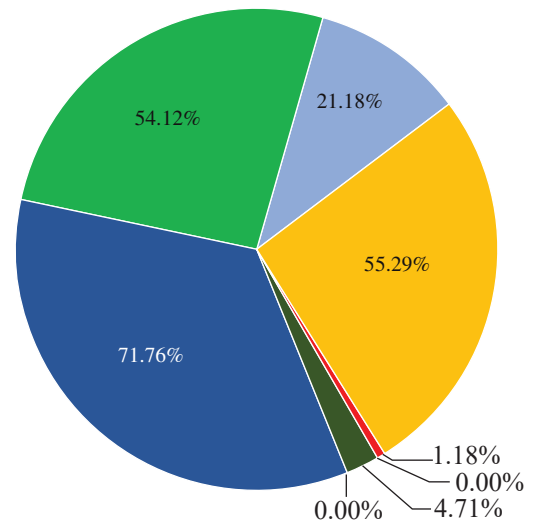
■ 2 week before surgery ■ 1 week before surgery
 ■ 5 days before surgery ■ 3 days before surgery
 ■ Never use before surgery

Fig. (2). Pie Chart showing the Preoperative Duration chosen by Orthopaedic Surgeons for the use of Pharmacological Anticoagulation.



■ No postoperative use ■ 3 days after surgery
 ■ 5 days after surgery ■ 1 week after surgery
 ■ 2 week after surgery ■ 4 week after surgery
 ■ 6 week after surgery

Fig. (3). Pie Chart showing the Postoperative Duration chosen by Orthopaedic Surgeons for the use of Pharmacological Anticoagulation.



■ Tumor surgery ■ Trauma surgery
 ■ Sports surgery ■ Paediatric Orthopedic surgery
 ■ Foot and Ankle surgery ■ Iliazirov surgery
 ■ Arthroplasty ■ Acetabulum and pelvis surgery

Fig. (4). Pie Chart showing the choice of Orthopaedic Surgeons for using of Pharmacological Anticoagulation in Different Disciplines of Orthopedic Surgeries.

Regarding the prescription of anticoagulants, a majority of 70 (82.35%) surgeons claimed that they have prescribed the anticoagulant occasionally during their practice contrary to 11 (12.94%) who have always used the anticoagulant. 4 (4.71%) surgeons had never used anticoagulants during their practice. The majority i.e., 60 (70.59%) of the doctors have never used anticoagulation before surgery. 8 (9.4%) of participants used anticoagulation one week before surgery while none of them used it 2 weeks before surgery (Fig. 2). Responses were variable regarding the postoperative duration of anticoagulation with 21 (24.28%) reported using three days after surgery while 15 (17.65%) used till two weeks after surgery. 5 (5.8%) surgeons continued anticoagulation till 4 to 6 weeks (Fig. 3).

Orthopedic surgeons were then inquired about the incidence of thromboembolism in the last one year as per their observation for which 69 (81.18%) responded it to be less than 1%, 15 (17.65%) reported 1-3% incidence and 1 (1.18%) reported 3-5% incidence. The most preferred surgery for pharmacological anticoagulation was arthroplasty reported by 61 (71.76%) of respondents while pharmacological anticoagulant was also further employed by 47 (55.3%) and 46 (54.1%) of surgeons in Trauma Surgery and Acetabulum & Pelvis Surgery, respectively (Fig. 4).

DISCUSSION

Anticoagulation is recommended for lower limb surgeries across the world due to immobilization, major surgical approach, and use of prosthesis [11]. However, the guidelines differ in terms of recommendation in choice of drugs, duration of anticoagulation, dosing, and mechanical anticoagulation methods. The variability in guidelines has led to differences in clinical practice among different orthopedic surgeons. This survey was carried out to analyze the possible differences in pharmacological anticoagulation with the success achieved in avoiding VTE as per the individual practice of clinicians. The results may further be used to uplift the standard of patient care regarding VTE prophylaxis by providing appraisals in clinical practice.

The results reflect the satisfactory use of pharmacological anticoagulation as an overwhelming majority of surgeons are using it. The literature has not recommended pharmacological anticoagulation for low-risk patients going through cast and plaster, lower leg, foot, and ankle surgeries, and minor surgeries [12, 13]. Hence, we asked whether the surgeons have used pharmacological anticoagulation for all lower limb surgeries or selective surgeries. The responses showed that 82.35% of them used anticoagulation selectively. Arthroplasties and pelvis acetabulum surgeries are considered the most thrombogenic surgeries with the highest rate of VTE so anticoagulation is recommended [14, 15]. Our results show that 71.76 and 51.5% of surgeons use anticoagulation for these surgeries. However, 55.1% of respondents used anticoagulation for

trauma surgeries. According to recent literature, pharmacological anticoagulation should be advised cautiously in trauma patients prioritizing mechanical prophylaxis over pharmacological prophylaxis due to the high risk of bleeding whereas widespread use of pharmacological anticoagulation is of serious concern in trauma patients [16]. The respondents reported LMWH as the most commonly used drug. However, recent clinical trials have reported better and more convenient results with Rivaroxaban, and Dabigatran which can be taken orally avoiding needle-stick infection and needle phobia among patients [17, 18]. In our results, only 17.65% of surgeons were using Rivaroxaban while none of the respondents knew about Dabigatran. Direct Oral Anticoagulants (DOAC) need to be adopted as they may increase patient compliance in extended use.

Preoperative anticoagulation in lower limb surgeries due to immobilization and associated fracture should be practiced with a bridging therapy by LMWH 5 days before surgery [19]. However, few surgeons (29.45%) are using anticoagulation preoperatively while a majority of surgeons are not using it preoperatively. This might result in VTE preoperatively and dislodgement during surgery. AAOS has recommended 2-weeks VTE prophylaxis postoperatively while ASH and ACCP have recommended extended 5-week use of VTE prophylaxis after major lower limb orthopedic procedures. Hence, a wide variation is observed in our results arising from 2-week to 6-week use of pharmacological anticoagulation.

From recent data, 1-3% of incidences of VTE are acceptable after major surgeries [20]. From our survey, we found that 81.18% of surgeons faced less than 1% of incidences of VTE per year. The results reflect that no regimen is superior to others in terms of VTE prophylaxis as all the surgeons have a similar rate of success. However, VTE prophylaxis that is cost-effective, convenient for patient and clinician, and with the lowest adverse effects should be brought into clinical practice as a superior VTE prophylaxis regimen.

LIMITATION

The response rate was low due to time limitations and busy schedules under the COVID-19 pandemic of surgeons which is the major limitation to this survey.

CONCLUSION

We may conclude that the use of anticoagulation is prevalent among orthopedic surgeons in Pakistan. But significant differences are observed regarding the duration. However, no regimen can be claimed superior to others as all are reporting a low incidence of thromboembolism. Time, adverse effects, cost-effectiveness, and convenience should be investigated to suggest the best perioperative pharmacological anticoagulation. The surgeons need to prescribe DOAC such as Rivarox-

aban and Dabigatran as newer and safer agents of choice while extended postoperative pharmacological anticoagulation of 28-35 days needs to be adopted.

AUTHORS' CONTRIBUTION

Sheikh Muhammad Ebad Ali: Critical revision, Data acquisition, Data interpretation, Data analysis.

Badaruddin Sahito: Critical revision, Data acquisition.

Syeda Iqra Qadri: Data collection, Drafting, Data analysis.

Hira Iqbal Naviwala: Data collection, Drafting, Data analysis.

Omer Awan: Data entry, Data collection, Drafting.

Muhammad Mohsin Mushtaq: Data entry, Data collection, Drafting.

CONFLICT OF INTEREST

Declared none.

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REFERENCES

- [1] Scheres LJJ, Lijfering WM, Cannegieter SC. Current and future burden of venous thrombosis: Not simply predictable. *Res Pract Thromb Haemost.* 2018;2(2):199-208.
- [2] Lee LH, Gallus A, Jindal R, Wang C, Wu C-C. Incidence of venous thromboembolism in asian populations: A systematic review. *Thromb Haemost* 2017; 117(12): 2243-60.
- [3] Keller K, Hobohm L, Engelhardt M. Risk of venous thromboembolism after endoprosthetic surgeries: Lower versus upper extremity endoprosthetic surgeries. *HeartVessels* 2019; 34(5): 815-23.
- [4] Chopard R, Albertsen IE, Piazza G. Diagnosis and treatment of lower extremity venous thromboembolism: A Review. *JAMA* 2020; 324(17): 1765-76.
- [5] Gade IL, Kold S, Severinsen MT, *et al.* Venous thromboembolism after lower extremity orthopedic surgery: A population-based nationwide cohort study. *Res Pract Thromb Haemost* 2021; 5(1): 148-58.
- [6] Tritschler T, Kraaijpoel N, Le Gal G, Wells PS. Venous thromboembolism: Advances in diagnosis and treatment. *JAMA* 2018; 320(15): 1583-94.
- [7] Anderson DR, Morgano GP, Bennett C, *et al.* American society of hematology 2019 guidelines for management of venous thromboembolism: Prevention of venous thromboembolism in surgical hospitalized patients. *Blood Adv* 2019; 3(23): 3898-944.
- [8] 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): e278S-e325S.
- [9] Flevas DA, Megaloikonomos PD, Dimopoulos L, Mitsiokapa E, Koulouvaris P, Mavrogenis AF. Thromboembolism prophylaxis in orthopaedics: An update. *EFORT Open Rev.* 2018 Apr 27;3(4):136-148.
- [10] Bartlett MA, Mauck KF, Stephenson CR, Ganesh R, Daniels PR. Perioperative venous thromboembolism prophylaxis. *Mayo Clin Proc* 2020;95(12): 2775-98.
- [11] Horner D, Goodacre S, Pandor A, *et al.* Thromboprophylaxis in lower limb immobilisation after injury (TiLLI). *Emerg Med J* 2020; 37(1): 36.
- [12] Nemeth B, Douillet D, le Cessie S, Penalzoza A, Mounneh T, Roy PM, Cannegieter S. Clinical risk assessment model to predict venous thromboembolism risk after immobilization for lower-limb trauma. *Clin Med.* 2020; 20: 100270.
- [13] Patterson JT, Morshed S. Chemoprophylaxis for Venous Thromboembolism in operative treatment of fractures of the tibia and distal bones: A systematic review and meta-analysis. *J Orthop Trauma.* 2017; 31(9): 453-460.
- [14] Kapoor CS, Mehta AK, Patel K, Golwala PP. Prevalence of deep vein thrombosis in patients with lower limb trauma. *J Clin Orthop Trauma* 2016; 7(Suppl 2): 220-4.
- [15] Wang P, Kandemir U, Zhang B, *et al.* Incidence and risk factors of deep vein thrombosis in patients with pelvic and acetabular fractures. *Clin Appl Thromb Hemost* 2019; 25: 1076029619845066.
- [16] Paydar S, Sabetian G, Khalili H, *et al.* Management of deep vein thrombosis (dvt) prophylaxis in trauma patients. *Bull Emerg Traum* 2016; 4(1): 1-7.
- [17] Blin P, Samama CM, Sautet A, *et al.* Comparative effectiveness of direct oral anticoagulants versus low-molecular weight heparins for the prevention of venous thromboembolism after total hip or knee replacement: A nationwide database cohort study. *Pharmacol Res* 2019; 141: 201-7.
- [18] Highcock AJ, As-Sultany M, Finley R, Donnachie NJ. A Prospective cohort comparative study of rivaroxaban, dabigatran, and apixaban oral thromboprophylaxis in 2431 hip and knee arthroplasty patients: Primary efficacy outcomes and safety profile. *J Arthroplasty* 2020; 35(11): 3093-8.
- [19] Szklanny K, Jakubek M, Zbierska-Rubinkiewicz K, Undas A. Bridging anticoagulation in patients treated with vitamin K antagonists prior to trochanteric and hip fracture surgeries: The current practice. *Adv Clin Exp Med* 2019; 28(4): 469-77.
- [20] Kahn SR, Shivakumar S. What's new in VTE risk and prevention in orthopedic surgery. *Res Pract Thromb Haemost* 2020; 4(3): 366-76.