www.hsmc.gr/en/pharmakeftiki-journal/

PHARMAKEFTIKI, 37, 2S, 2025 | 438-441 REVIEW

https://doi.org/10.60988/p.v37i2S.250

Enoxaparin thromboprophylaxis during pregnancy: a review of pharmacist-led interventions

Ghaith Mohammed Abdulridha[1,*], Ihsan Salah[2]

[1]*Al-Sadiq Teaching Hospital, Hillah, Iraq*
[2]*Department of Clinical Pharmacy, College of Pharmacy, University of Kufa, Najaf, Iraq*

KEY WORDS:
enoxaparin; thromboprophylaxis; venous thromboembolism; pregnancy; pharmacist-led interventions

ARTICLE INFO:
Received: December 04, 2024
Revised: December 30, 2024
Accepted: January 13, 2025
Available online: October 10, 2025

ABSTRACT

Enoxaparin, a low-molecular-weight heparin, is a critical agent for anticoagulation during pregnancy due to its efficacy and safety. It is generally used as a prophylactic agent against venous thromboembolism; a particularly serious and dangerous situation when occurring during pregnancy. However, the enoxaparin administration during pregnancy requires accurate dosing and monitoring. Complications as a result of prescribing mistakes highlight the need for competitive control strategies. This review attempts to examine the effects of selected pharmacist-led interventions on enoxaparin-induced thromboprophylaxis in pregnant patients. Based on the findings of studies from the literature, we herein emphasize the crucial role of pharmacists in improving anticoagulation treatment goals, correcting dosing errors, ensuring patient adherence, and protecting from the development of adverse events during antenatal thromboprophylaxis.

1. Introduction

Venous thromboembolism (VTE), which includes deep vein thrombosis and pulmonary embolism, presents a significant risk during pregnancy. Pregnancy induces a hyper-coagulable state characterized by increased pro-coagulant factor levels and decreased levels of natural anticoagulants, thereby elevating the risk of thrombosis. Additionally, the increased blood volume during pregnancy raises venous pressure, further predisposing pregnant women to VTE. The incidence of VTE in pregnant women is approximately 1 in 1,000 pregnancies, with the highest risk occurring during the third trimester and the immediate post-

*** CORRESPONDING AUTHOR:**
Ghaith Mohammed Abdulridha, Al-Sadiq Teaching Hospital, Hillah, Iraq; e-mail: ghaith.mohammed128@gmail.com

PHARMAKEFTIKI, 37, 2S, 2025 | 438-441

partum period. The serious consequences of VTE highlight the critical need for effective thromboprophylaxis in high-risk pregnant populations, as it plays a pivotal role in safeguarding maternal and foetal health. Enoxaparin, a low-molecular-weight heparin, is commonly used as a prophylactic agent due to its predictable pharmacokinetic profile and favourable safety characteristics[1].

Enoxaparin is the preferred anticoagulant for the induction of thromboprophylaxis in pregnant women, favoured over unfractionated heparin due to its predictable pharmacokinetics, its lower risk of heparin-induced thrombocytopenia, and its limited placental transfer, which together enhance its safety profile. It is widely used as a prophylactic agent to prevent VTE in women with a history of VTE, thrombophilia, or other risk factors (including obesity and prolonged immobility)[1]. Despite the benefits of enoxaparin therapy during pregnancy, several challenges must be considered. Precise dosing is of paramount importance: underdosing can lead to therapeutic failure, while overdosing increases the risk of haemorrhage. Ensuring patient adherence to prescribed regimens, especially for self-administered treatments, is often challenging. Moreover, poor adherence can significantly impact treatment efficacy[1].

The inherent risks associated with prescribing errors and the complex nature of managing enoxaparin therapy during pregnancy necessitate a robust approach to prescribing practices. Pharmacists, with their specialized expertise in pharmacotherapy, are uniquely positioned to address these challenges and enhance patient safety. The pharmacists' in-depth knowledge of drug interactions and patient-specific factors allows them to ensure accurate dosing of enoxaparin, thereby minimizing the risk of underdosing or overdosing. Pharmacists are skilled at providing clear and concise patient education regarding medication administration, potential side-effects, and the importance of adherence to prescribed regimens. Their specialized expertise in pharmacotherapy is invaluable in navigating the complexities of this medication and ensuring its safe and effective use[2].

The aim of this review was to summarize key findings of interventions led by pharmacists in order to optimize enoxaparin thromboprophylaxis during pregnancy. This review was conducted by systematically searching key databases, including PubMed, Scopus, and the Cochrane Library, for research articles published between 2000 and 2024 that assessed the role of pharmacists in improving enoxaparin thromboprophylaxis during pregnancy. The search method employed a variety of terms, including "pharmacist intervention", "enoxaparin", "thromboprophylaxis", "pregnancy", and "venous thromboembolism". In order to be included in the evaluation, studies had to meet a number of criteria. Firstly, the studies had to include a pharmacist-led intervention. Secondly, the studies had to report on one or more of the following outcomes: prescribing accuracy, dosing, or patient protection.

2. Interventions in Europe and a review from the USA

In France, Bedouch *et al.*[3] have evaluated the impact of clinical pharmacists' interventions in hospital settings. Their study suggests that pharmacist-led interventions ended in superior medication control[3]. Similarly, Löffler *et al.*[4] have conducted a qualitative study in Germany with the goal of analysing the perceptions regarding interprofessional collaboration among general practitioners and community pharmacists. Their study emphasizes the significance of effective collaboration in optimizing patient care, even though it does not focus on specific remedy-associated interventions[4].

In a different context, Daughety *et al.*[5] have conducted a literature review and assessment of the control of anticoagulation in pregnant women with mechanical heart valves. Their findings provide precious insights into the broader context of anticoagulation management and highlight the need of improving anticoagulation control practices across heterogeneous patient populations[5].

3. Interventions in Arab countries

In Arab countries, the contribution of pharmacists to optimal enoxaparin-induced thromboprophylaxis is increasingly recognized, although the degree of pharmacist involvement varies. In Saudi Arabia, a study

PHARMAKEFTIKI, 37, 2S, 2025 | 438-441

Table 1. *Outline of the studies discussed in this review.*

Study	Location	Intervention	Outcome
Bedouch *et al.* (2008)[3]	France	clinical pharmacist-led interventions in hospitals	improved medication management and patient outcomes
Löffler *et al.* (2017)[4]	Germany	interprofessional collaboration between general practitioners and community pharmacists	enhanced understanding of collaborative care benefits
Daughety *et al.* (2020)[5]	USA; global	management of anticoagulation in pregnant women with mechanical heart valves	relevant for broader context of anticoagulation management; not specific to enoxaparin
Shilbayeh (2020)[6]	Saudi Arabia	pharmacist-led educational video on warfarin	demonstrated the role of educational interventions in improving medication management
Ahmed *et al.* (2017)[7]	Sudan	clinical pharmacist-led interventions in an anticoagulation clinic	improved warfarin dosing accuracy and enhanced patient outcomes
Obaid *et al.* (2022)[8]	Middle East	review of pharmacy practice and clinical pharmacy research	emphasizes the potential of pharmacist-led interventions in addressing healthcare challenges
Mikhael *et al.* (2024)[9]	Iraq	pharmacist-led nurse education on enoxaparin injection technique	improved injection technique accuracy and reduced complications
Suker *et al.* (2021)[10]	Iraq	pharmacist-led intervention for venous thromboembolism prophylaxis after caesarean section	clinical pharmacist-led intervention has resulted in encouraging guideline implementations, thereby improving the accuracy of the thromboprophylaxis duration and dosing

by Shilbayeh[6] has demonstrated the impact of pharmacist-led educational videos on warfarin utilization. Although not specific to enoxaparin, this study provides evidence of the effectiveness of pharmacist-led educational programs[6]. The same is true in the case of Ahmed *et al.*[7], which have investigated the impact of an intervention by hospital pharmacists in an anticoagulation clinic in Sudan. The study has found that the intervention led to marked improvements in anticoagulation management, including warfarin dosing accuracy and patient outcomes[7]. Furthermore, a study of the scope of pharmaceutical practice and clinical pharmaceutical research throughout the Middle East that has been conducted by Obaid *et al.*[8] has highlighted the power of pharmacist-led interventions in addressing a variety of healthcare challenges, including those related to anticoagulation. The study emphasizes the wider context of pharmacist-led involvement in the development of healthcare practices, as well as its capability for ensuring a better anticoagulation control[8].

In Iraq, pharmacist-led interventions have had a vast effect on enoxaparin administration, thereby highlighting the potential role of pharmacists in securing the enhancement of medication control. A study conducted by Mikhael *et al.*[9] at the Baghdad Teaching Hospital has evaluated the efficacy of pharmacist-led nurse training on enoxaparin injection strategies. The study reports an improved accuracy of the injection method and a decrease in associated complications, thereby demonstrating the effectiveness of specialized academic programmes[9]. Similarly, Suker *et al.*[10] have examined the impact of a pharmacist-led intervention on the practice of enoxaparin thromboprophylaxis after caesarean delivery. This study reports the promising potential for the pharmacist involvement in the post-caesarean healthcare, with respect to improving enoxaparin dosing accuracy[10]. The aforementioned studies emphasize the growing importance of integrating pharmacists into multidisciplinary healthcare groups as a way of improving patient care.

4. Conclusion

PHARMAKEFTIKI, 37, 2S, 2025 | 438-441

The existing literature regarding pharmacist-led interventions in the context of enoxaparin-induced thromboprophylaxis during pregnancy is remarkably poor and in need of urgent enrichment. However, the existing studies suggest a critical potential of pharmacists in optimizing enoxaparin thromboprophylaxis during pregnancy. The implementation of pharmacist-led interventions can reduce dosing errors and improve outcomes.

Acknowledgements

We are grateful for the support received from the Faculty of Pharmacy of the University of Kufa.

Conflicts of interest

None exist.

ORCIDs

0009-0005-1694-7404 (G.M. Abdulridha); 0000-0001-6603-2054 (I. Salah)

References

1. Cox S., Eslick R., McLintock C. Effectiveness and safety of thromboprophylaxis with enoxaparin for prevention of pregnancy-associated venous thromboembolism. *J. Thromb. Haemost.* 17(7), 1160–1170, 2019. DOI: 10.1111/jth.14452
2. Austin J., Barras M., Sullivan C. Interventions designed to improve the safety and quality of therapeutic anticoagulation in an inpatient electronic medical record. *Int. J. Med. Inform.* 135, 104066, 2020. DOI: 10.1016/j.ijmedinf.2019.104066
3. Bedouch P., Charpiat B., Conort O., Rose F.X., Escofier L., Juste M., *et al.* Assessment of clinical pharmacists' interventions in French hospitals: results of a multicenter study. *Ann. Pharmacother.* 42(7), 1095–1103, 2008. DOI: 10.1345/aph.1L045
4. Löffler C., Koudmani C., Böhmer F., Paschka S.D., Höck J., Drewelow E., *et al.* Perceptions of interprofessional collaboration of general practitioners and community pharmacists – a qualitative study. *BMC Health Serv. Res.* 17(1), 224, 2017. DOI: 10.1186/s12913-017-2157-8
5. Daughety M.M., Zilberman-Rudenko J., Shatzel J.J., McCarty O.J.T., Raghunathan V., DeLoughery T.G. Management of anticoagulation in pregnant women with mechanical heart valves. *Obstet. Gynecol. Surv.* 75(3), 190–198, 2020. DOI: 10.1097/OGX.0000000000000751
6. Shilbayeh S.A.R. The impact of a pharmacist-led warfarin educational video in a Saudi setting. *J. Pharm. Bioallied Sci.* 12(4), 413–422, 2020. DOI: 10.4103/jpbs.JPBS_188_20
7. Ahmed N.O., Osman B., Abdelhai Y.M., El-Hadiyah T.M.H. Impact of clinical pharmacist intervention in anticoagulation clinic in Sudan. *Int. J. Clin. Pharm.* 39(4), 769–773, 2017. DOI: 10.1007/s11096-017-0475-x
8. Obaid D., El-Dahiyat F., Babar Z.U. Pharmacy practice and clinical pharmacy research in the Middle East: a scoping review of studies from Bahrain, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, United Arab Emirates, and Yemen. *J. Pharm. Policy Pract.* 15(1), 40, 2022. DOI: 10.1186/s40545-022-00434-y
9. Mikhael E.M., Nassir K.F., Alkhaqani A.L., Jabbar Z.R. Effectiveness of pharmacist-led nurse education on enoxaparin injection technique in Baghdad Teaching Hospital, Iraq. *Al-Rafidain J. Med. Sci.* 6(1), 202–207, 2024. DOI: 10.54133/ajms.v6i1.622
10. Suker S.E.J., Al-Ameen A.A.H., Hadi N.R. Evaluating the current practice of post cesarean thromboprophylaxis and enhancing guideline adherence in Al-Najaf hospitals. *Med. Arch.* 75(5), 351–355, 2021. DOI: 10.5455/medarh.2021.75.351-355

HOW TO CITE:
Abdulridha G.M., Salah I. Enoxaparin thromboprophylaxis during pregnancy: a review of pharmacist-led interventions. *Pharmakeftiki* 37(2s), 438-441, 2025. https://doi.org/10.60988/p.v37i2S.250