JIMGS
Journal for International Medical Graduates
Volume 09 (01) September 22nd, 2024
A Systemic Review

Aspirin Versus Enoxaparin for Deep Vein Thrombosis Prevention After Orthopedic Surgery: A Review of Efficacy and Safety

Sayed A Mahmud, Anura Manandhar,Ghadeer Sabir, Hala Abdeldady, Adoum Oumar Abakar, Ravindra Reddy Gangavarapu, Iana Malasevskaia
Journal for International Medical Graduates

ABSTRACT

Deep vein thrombosis (DVT) is a significant complication following orthopedic surgery. This review evaluates the comparative efficacy and safety of aspirin and enoxaparin for DVT prophylaxis in this patient population. A comprehensive literature search identified relevant randomized controlled trials (RCTs), retrospective studies, and systematic reviews with meta-analyses comparing these two medications. The findings regarding aspirin's efficacy compared to enoxaparin are mixed. While some studies suggest comparable effectiveness in preventing DVT, others indicate a potential advantage for enoxaparin. However, aspirin offers advantages in terms of ease of administration (oral medication), potentially lower bleeding risk, and potentially improved patient satisfaction and adherence. Drawing definitive conclusions is limited by heterogeneity among the included studies. Variations in patient populations, surgical procedures, and follow-up durations hinder a more conclusive comparison. Additionally, the potential for bias in some studies necessitates a cautious interpretation of the results. This review also has limitations, as it does not explicitly appraise the methodological quality of each included study. Despite these limitations, aspirin emerges as a potentially viable alternative, and perhaps even an excellent option, for DVT prophylaxis after orthopedic surgery in specific scenarios. However, limitations within the current evidence necessitate further research with standardized protocols and rigorous methodological evaluation. Individualized approaches that consider patient-specific risk factors and surgical procedures are crucial. If future research confirms aspirin's efficacy and safety profile, its ease of use and potential benefits could lead to it becoming a preferred option for DVT prophylaxis.

Keywords: Aspirin, Enoxaparin, LMWH, Deep Vein Thrombosis, DVT, Venous Thromboembolism, VTE, Orthopedic Surgery.

Introduction & Background

Orthopedic surgeries are common procedures performed across all age groups globally. In 2018, In the United States, there were 14,365,200 total operating room procedures performed during 9,605,500 total inpatient states, 21 percent of all operating room procedures constituted musculoskeletal procedure [1]. Knee arthroplasty and hip replacement are among the top five OR procedures for adults aged 45 years and older [2]. Recent data indicates that in 2023, the United States performed approximately 766,000 hip replacements and 1.3 million knee replacements, representing increases of 3.8% and 5.1%, respectively, from the previous year. The fastest-growing segments of these procedures were revision knee procedures, which increased by 8.1% from 2021, and primary knee procedures, which increased by 5.0% to 1.08 million [3].

Postoperative deep vein thrombosis (DVT) presents a significant complication following major surgical procedures, particularly those involving the abdominal, pelvic, hip, or leg regions. Reduced mobility associated with the postoperative period can impede venous blood flow within these deep structures, creating a milieu conducive to thrombus formation. High-risk DVT can develop as early as 2–10 days postoperatively, with a potential window of vulnerability extending to 3 months [4]. The incidence of DVT after orthopedic surgery can vary depending on the type of surgery and whether preventive measures are taken. Without prophylaxis, up to 80% of patients may develop DVT after total hip arthroplasty (THA) or total knee arthroplasty (TKA). With prophylaxis, the incidence of DVT is estimated to be around 3% [5]. One study found a cumulative incidence of 2.22% in patients undergoing major orthopedic surgery, including knee arthroplasty, hip arthroplasty, and femur fracture repair [6]. Another study found that DVT rates were highest in TKR patients (58.1%), followed by HFS patients (42.0%), and then THR patients (25.6%) [7]. The annual incidence of DVT after major lower limb orthopedic surgeries is 70.67 per 100,000 people, adjusted for age and gender [8]. However, the exact number of people affected by DVT is unknown.

First-line deep vein thrombosis prophylaxis options include low-molecular-weight heparins (LMWHs) or Enoxaparin, a 4-enopyranosuronate sodium structure at the non-reducing end of the chain, prepared by depolymerization of the benzylic ester of porcine mucosal heparin. Enoxaparin is administered subcutaneously [9].

Aspirin, a well-known analgesic used in the treatment of mild to moderate pain, also has anti-inflammatory

and antipyretic properties. It acts as an inhibitor of cyclooxygenase, resulting in the inhibition of the biosynthesis of prostaglandins. Aspirin also inhibits platelet aggregation and is used in the prevention of arterial and venous thrombosis [10].

The management of venous thromboembolism (VTE) prophylaxis after elective orthopedic surgery remains a subject of ongoing investigation. While low-molecular-weight heparin (LMWH) has been a mainstay of prophylaxis, recent studies suggest no clear superiority over aspirin for VTE prevention in fracture patients [11]. This raises the question of whether alternative options like Aspirin, with its advantages in terms of cost and ease of administration compared to injectable medications like Enoxaparin, might be equally effective for certain surgical procedures.

Therefore, this literature review aims to compare the efficacy of Aspirin to Enoxaparin for DVT prevention after elective orthopedic surgery.

RESULTS & DISCUSSION

The effects of aspirin and LMWH enoxaparin on VTE prevention following major orthopedic procedures have been investigated, with conflicting results reported across multiple studies. To gain a comprehensive understanding of this topic, we conducted a thorough search in PubMed, Embase, Cochrane library, EBSCO, Gray Literature databases, and ClinicalTrial.Gov register using keywords such as "aspirin," "enoxaparin," "deep vein thrombosis," "orthopedic surgery," and "efficacy." The retrieved studies provide valuable insights into the comparative efficacy and potential mechanisms of action of these two thromboprophylactic agents in the context of major orthopedic procedures.
In this review, we synthesize the key findings from six studies to elucidate the potential role of aspirin as an alternative to enoxaparin for the prevention of DVT following elective orthopedic surgeries. The reviewed literature suggests that while enoxaparin has long been the mainstay of VTE prophylaxis, aspirin may be a viable option that offers practical advantages in certain patient populations and surgical settings (Table 1).

Table 1. Summary of Included Studies on Aspirin vs. Enoxaparin for DVT Prevention after Elective Orthopedic Surgery

Study design/ Author/Year	Intervention/ (N)	Control/ (N)	Outcome Measured/Methods	Duration of Follow up / Result	Conclusion
RCT Haac et al., 2020, [12]	Aspirin 81-mg twice daily (n = 165)	Enoxaparin 30 mg twice daily (n=164)	Composite endpoint of bleeding complications, deep surgical site infection, deep vein thrombosis (DVT), pulmonary embolism, and death Methods: Global Rank test and weighted time to event analysis	Follow Up 90 days after injury **Result (Global Rank Test)**No evidence of superiority between LMWH or aspirin (p=0.73) **Result (Weighted Time to Event)**LMWH had a 60.5% probability of VTE prevention benefit, but not statistically significant (p=0.59).	Aspirin may be a reasonable alternative to LMWH for VTE prophylaxis in fracture patients, considering similar effectiveness and patient preference for oral medication.
Pragmatic, Multicenter RCT	Aspirin 81 mg twice daily (n=6101)	Enoxaparin 30 mg twice daily (n=6101)	Primary: Death from any cause at 90 days	In-hospital + median 21 days post-discharge	Aspirin was non-inferior to LMWH in preventing
Major Extremity Trauma Research Consortium (METRC) 2023, [13]			Secondary: Deep-vein thrombosis (DVT), pulmonary embolism (PE), bleeding complications	Follow Up 90 days after injury **Death:** No statistically significant difference (Aspirin: 0.78%, LMWH: 0.73%) **DVT:** More frequent in Aspirin group (2.51%) compared to LMWH (1.71%) **PE:** Similar rates in both groups (1.49%) **Bleeding:** Similar rates in both groups	death at 90 days and associated with low rates of DVT, PE, and mortality. However, LMWH showed a lower risk of DVT compared to Aspirin.
Retrospective Cohort study Pretorius et al., 2020, [14]	Enoxaparin (40mg) given within 12 hours of surgery and continued daily until	The study compared the observed VTE rates in this aspirin-using group to rates	Rate of VTE (DVT or PE) within 3 months Methods: Retrospectiv	**Overall VTE** rate: 1.19% (14/1178) **DVT rate:** 0.59% (7/1178)	Aspirin with mechanical prophylaxis may be comparable to other VTE medications

Study design/ Author/Year	Intervention/ (N)	Control/ (N)	Outcome Measured/Methods	Duration of Follow up / Result	Conclusion
	discharge. n= 1178 patients (721 undergoing THR and 457 undergoing TKR) Aspirin (once daily) for 4 weeks after discharge. All patients also received mechanical prophylaxis with compression stockings (unless contraindicated).	reported in other studies using various VTE prophylaxis medications.	e review of medical records	**PE rate**: 0.59% (7/1178) No **deaths** within 3 months	for THA/TKA. Further research needed on aspirin alone vs. combined approach.
A secondary analysis from the CRISTAL cluster randomized trial, CRISTAL Study Group, 2024, [15]	Aspirin (100mg daily) for 35 days (hip) or 14 days (knee) (n=7238)	Enoxaparin (40 mg daily) for 35 days (hip) or 14 days (knee) (n=5146)	The primary outcome was symptomatic VTE within 90 days	**Aspirin: VTE rate** 3.27% (226/6901) **Enoxaparin: VTE rate** 1.76% (85/4827)	Enoxaparin is more effective than Aspirin for preventing VTE after hip/knee arthroplasty. Enoxaparin superior to Aspirin (p=0.004
RCT	Group A:	Ki	Incidence of	Rivaroxaban	Rivaroxaban
Zou et al., 2014, [16]	Rivaroxaban 10 mg daily (oral) Group B: LMWH 4000 IU daily (subcutaneous injection) Group C: Aspirin 100 mg daily (oral) for 14 days Followed for 4 weeks Total n= 324 patient		DVT Blood loss Wound complications (infections, etc.) Subcutaneous ecchymosis (bruising) Limb swelling	had a lower **DVT rate** compared to aspirin ($p = 0.029$) and LMWH ($p = 0.017$). Rivaroxaban led to more **hidden blood loss** ($p < 0.01$) and **wound complications** ($p < 0.05$) compared to both aspirin and LMWH. No significant difference in DVT rates between aspirin and LMWH ($p = 0.831$).	may be more effective than aspirin or LMWH in preventing DVT following knee surgery ($p < 0.05$). However, this benefit is offset by increased bleeding and wound complications ($p < 0.05$). Aspirin appears equally effective as LMWH for DVT prophylaxis ($p > 0.05$) and may be a suitable alternative for some patients due to its lower bleeding risk.
RCT Cortes-De la Fuente et el., 2021, [17]	Aspirin 100 mg /day, 30 days (n= 188)	Enoxaparin 40 mg to 60 mg/ every 24 hours, 30 days (n= 214)	Primary outcomes: thromboembolic disease, symptomatic DVT,pulmonary embolism, and bleeding events. Secondary outcomes: Superficial surgical wound infections. Acute Myocardial Infarction (AMI)	**Thromboembolic Disease**: Enoxaparin group: 3 cases (1.4%) Aspirin group: 2 cases (1.06%) **Bleeding Events:** Minor bleeding: Enoxaparin group: 4 cases (1.86%) Aspirin group: 3 cases (1.59%) **Secondary Outcomes:** Superficial surgical wound infections: 5 cases (1.24%) AMI within 30 days: 1 case in the enoxaparin group	Aspirin is safe, and effective in antithrombotic prophylaxis in patients operated on total knee arthroplasty.

RCT | Randomized Controlled Trial
N | Number
VTE | Venous Thromboembolism
LMWH | Low Molecular Weight Heparin
DVT | Deep Vein Thrombosis
THA | Total Hip Arthroplasty
TKA | Total Knee Arthroplasty
PE | Pulmonary Embolism
P | P value
AMI | Acute Myocardial Infarction

Several investigations have explored the potential of aspirin as a viable alternative to enoxaparin, a commonly used low-molecular-weight heparin (LMWH).

Haac et al. (2020) conducted a randomized controlled trial (RCT) involving 329 patients and found no significant difference in the incidence of thromboembolic events between enoxaparin and aspirin for thromboprophylaxis in fracture patients [12]. Notably, this study also reported a 9% patient preference for the oral administration of aspirin compared to enoxaparin injections, suggesting potential advantages in terms of patient comfort and adherence alongside comparable effectiveness [12].

Further research by Zou et al. (2014) [16] employed a comparative approach to evaluate a broader spectrum of antithrombotic agents, including aspirin, LMWH, and rivaroxaban, for DVT prophylaxis following orthopedic procedures. The findings suggest that aspirin and LMWH may demonstrate comparable efficacy in preventing DVT, with aspirin potentially offering a lower risk of bleeding complications. Rivaroxaban, while effective in DVT prophylaxis, appeared to be associated with an increased risk of bleeding and wound complications.

Supporting the potential role of aspirin, the retrospective review by Pretorius et al. (2020) [14] involving 1178 patients concluded that aspirin remains a relevant and potentially optimal pharmacological agent for preventing VTE after THA and TKA within the context of established guidelines. This study adds to the

growing body of evidence suggesting aspirin's efficacy in specific surgical contexts.

Cortes-De la Fuente et al. (2021) [17] investigated the use of aspirin compared to enoxaparin for thromboprophylaxis in patients undergoing total knee arthroplasty. Their RCT demonstrated the safety and efficacy of aspirin, with low bleeding rates and outcomes comparable to enoxaparin.

The application of aspirin in major extremity trauma has also been explored. The Major Extremity Trauma Research Consortium (METRC) conducted a significant RCT study, comparing the efficacy of aspirin versus enoxaparin for thromboprophylaxis in over 12,000 patients with major extremity trauma. The findings of this study revealed that aspirin demonstrated non-inferiority to enoxaparin in preventing death at the 90-day mark, showcasing low incidences of DVT, PE, and mortality. Notably, enoxaparin exhibited a lower risk of DVT in this specific patient cohort, although this disparity did not reach statistical significance. Furthermore, the study highlighted no substantial differences between the two groups concerning rates of pulmonary embolism, bleeding events, or mortality. This large-scale RCT provides compelling evidence supporting aspirin as a potential non-inferior alternative to enoxaparin, despite a slightly higher but statistically insignificant risk of DVT [13].

It is crucial to acknowledge conflicting findings from another RCT conducted across 31 hospitals in Australia [15]. This study, involving over 12,000 patients, found that aspirin compared to enoxaparin resulted in a significantly higher rate of symptomatic DVT and joint-related reoperations within 90 days.

To comprehensively analyze the current knowledge base on aspirin as an alternative to enoxaparin for DVT prophylaxis after orthopedic surgery, this review incorporates findings from four systematic reviews and meta-analyses, and one literature review (Table 2). This multifaceted approach will allow us to gain a deeper understanding of the current evidence landscape and illuminate the potential role of aspirin in DVT prophylaxis after orthopedic procedures.

Table 2. Comparison of Findings from Systematic Reviews and Meta-analyses on Aspirin vs. LMWH for VTE Prophylaxis after Orthopedic Surgeries

Author(s), Year	Type of Study	Aim of Study	N (Aspirin vs. LMWH)	Findings
Núñez et al., 2023, [11]	Systematic Review & Meta-Analysis	Evaluate efficacy of aspirin vs LMWH for VTE prophylaxis after THA/TKA	72,055 vs. 176,406	**Mortality**: P = 0.30 - No significant difference **Bleeding**: P = 0.22 - No significant difference **Wound Complications**: P = 0.85 - No significant difference
Meng et al., 2023, [18]	Meta-analysis of RCTs	Assess aspirin vs LMWH for VTE prophylaxis after TKA	Total N= 6772	**VTE:** Significantly higher risk with Aspirin (RR 1.46; 95% CI: 1.16-1.84) **DVT:** No significant difference (RR 1.22; 95% CI: 0.84-1.75) **PE:** No significant difference (RR 0.99; 95% CI: 0.25-3.98) **Bleeding:** No significant difference (RR 0.90; 95% CI: 0.71-1.14) **GI Bleeding:** No significant difference (RR 1.30; 95% CI: 0.21-8.17)
Singjie et al., 2022, [19]	Systematic review and meta-analysis of RCTs	Compare aspirin to other anticoagulants for VTE prophylaxis after major orthopedic surgery	Total N= 6220	**No statistically significant difference** between aspirin and other anticoagulants **VTE**: P = 0.25 **Mortality**: P = 0.69 **Bleeding events**: P = 0.61 **Wound complications**: P = 0.24
Farey et al., 2014, [20]	Systematic Review And Meta Analysis	Compare the efficacy and associated harms of aspirin and enoxaparin when used as VTE prophylaxis in the initial postoperative period following elective arthroplasty of the hip or knee	Total N= 1507	**No statistically significant difference** between aspirin and Enoxaparin **VTE** RR, 0.84; 95% CI: 0.41 to 1.75; p=0.65 **Major Bleeding Events** RR, 0.84; 95% CI: 0.08 to 9.16) **Minor Bleeding Event** RR, 0.77; 95% CI: 0.34 to 1.72 NOTE Included trials demonstrated a significant risk of bias, and Low to Very Low quality of evidence for primary outcomes, and Moderate to Very Low for secondary outcomes.
Wei et al., 2023, [21]	Systematic Review and Meta Analysis	Compare safety and efficacy of aspirin and LMWH for venous thromboembolism (VTE) prophylaxis in patients after orthopedic surgery	Total N= 13,851	**DVT** RR 0.61 [95% CI 0.27-1.39], I^2 = 62%, P = 0.24 NOTE The risk of DVT was comparable between the two groups when aspirin was combined with mechanical devices. However aspirin alone had a higher risk of DVT than LMWH

RCT | Randomized Controlled Trial **N** | Number; **VTE** | Venous Thromboembolism **LMWH** | Low Molecular Weight Heparin; **DVT** | Deep Vein Thrombosis; **THA** | Total Hip Arthroplasty; **TKA** | Total Knee Arthroplasty; **PE** | Pulmonary Embolism; **RR** | Relative Risk; **CI** |Confidence Interval; **P** | P value

The results regarding VTE risk were mixed. Núñez et al. (2023) [11], Singjie et al. (2022) [19], and Farey et al. (2014) [20] found no significant difference in VTE rates between aspirin and LMWH. However, Meng et al. (2023) [18] reported a significantly higher risk of VTE with aspirin compared to LMWH. Wei et al. (2023) [21] suggested a potential benefit for aspirin only when combined with mechanical prophylaxis. These inconsistencies highlight the need for further investigation into the efficacy of aspirin for VTE prevention, particularly considering the potential

influence of combined therapies with mechanical devices.

Most studies, including those by Núñez et al. (2023) [11], Singjie et al. (2022) [19], and Farey et al. (2014 [20]), reported no significant differences in bleeding events or wound complications between aspirin and LMWH. However, the quality of evidence in some cases was limited by potential bias, as acknowledged by Farey et al. (2014 [20]). More robust research is needed to definitively assess the safety profile of aspirin compared to LMWH.

Clinical Implication

The clinical implications of using aspirin as an alternative to LMWH for VTE prophylaxis after orthopedic surgery present a nuanced and multifaceted landscape. While the METRC study [13] indicates that aspirin may be non-inferior to LMWH in preventing adverse outcomes such as death, bleeding, and mortality, uncertainties persist. Patient preference for oral administration of aspirin over injectable LMWH adds a layer of consideration in the choice of prophylactic agent. Furthermore, the retrospective Cohort study by Pretorius et al., 2020, [14] underscores aspirin's continued relevance and potential efficacy in VTE prophylaxis following total hip and knee arthroplasty.

On the other hand, concerns arise from studies like Meng et al. [18], which highlight a significantly higher risk of VTE associated with aspirin compared to LMWH, challenging the notion of aspirin's efficacy as a standalone prophylactic agent. The potential mitigation of DVT risk with aspirin when combined with mechanical devices, as suggested by Wei et al. [21], introduces a promising avenue for optimizing prophylactic strategies but underscores the need for further investigation into the most effective combination therapy approach. Additionally, limitations in the quality of evidence in studies such as Farey et al. underscore the necessity for more robust research methodologies to strengthen the evidence base.

In navigating the complexities of aspirin versus LMWH for VTE prophylaxis after orthopedic surgery, an individualized approach emerges as paramount. Tailoring the choice between aspirin and LMWH to each patient's risk profile, the specific surgical context and the potential bleeding risk becomes essential in optimizing outcomes. Factors such as the patient's overall risk of VTE, the nature of the orthopedic procedure, and the patient's bleeding risk profile should inform the decision-making process. Furthermore, patient preferences regarding oral versus injectable administration play a significant role in determining the most suitable prophylactic agent.

Strengths and Limitations of Review

This literature review leverages a robust search strategy to comprehensively assess the current evidence on aspirin versus enoxaparin for DVT prophylaxis after orthopedic surgery. The review incorporates findings from various sources, including RCTs, retrospective studies, and systematic reviews with meta-analyses. This multifaceted approach offers a deeper understanding of the comparative efficacy and safety profiles of these two agents. The inclusion of summary tables for both RCTs and SRMA data further aids in visualizing and comparing key outcomes across studies. Notably, the review presents a balanced perspective by acknowledging both studies supporting and contradicting the use of aspirin as a viable alternative to enoxaparin.

Despite its strengths, this review also acknowledges limitations within the included studies and the review process itself. One limitation lies in the heterogeneity of the included studies. Variations in patient populations, surgical procedures, and follow-up durations across studies make direct comparisons and definitive conclusions challenging. Additionally, the potential presence of bias in some studies, as identified by Farey et al. (2014), could influence the overall results. Furthermore, the review itself has limitations. While it incorporates a wide range of studies, it does not explicitly evaluate the methodological quality of each included study. A more critical appraisal of the studies' strengths and weaknesses would enhance the overall robustness of the review. Lastly, the discussion on the reasons behind conflicting results across studies is limited. Exploring potential explanations, such as dosage variations or patient population differences, could provide a more nuanced understanding of the current evidence.

Future Research Directions

Looking ahead, future research must focus on conducting well-designed, large-scale studies to definitively establish the role of aspirin in VTE prophylaxis after orthopedic surgery. Exploring optimal dosage regimens, investigating the benefits of combining aspirin with mechanical devices, and assessing the long-term safety profiles are critical areas for further exploration. The decision-making process between aspirin and LMWH remains intricate, requiring a delicate balance between potential benefits and risks, emphasizing the importance of personalized patient assessment and ongoing research endeavors to refine prophylactic strategies in orthopedic surgery settings.

CONCLUSION

This review provides a thorough examination of the comparative efficacy and safety of aspirin versus enoxaparin for the prevention of DVT following orthopedic surgery. The evidence derived from randomized controlled trials and meta-analyses presents a nuanced landscape, with findings that vary significantly. While some studies indicate that aspirin may offer comparable efficacy to enoxaparin, others suggest that enoxaparin retains a potential advantage in reducing DVT risk, particularly in certain surgical contexts. Aspirin's appeal lies in its oral administration,

which enhances patient comfort and adherence, alongside a potentially lower risk of bleeding complications. These factors position aspirin as a compelling option for DVT prophylaxis in selected patient populations. However, the heterogeneity of the included studies, along with the potential for bias, underscores the need for cautious interpretation of the findings.

To advance the understanding of aspirin's role in DVT prevention, future research must prioritize rigorous, large-scale studies that standardize methodologies and explore optimal dosing regimens. Investigating the synergistic effects of combining aspirin with mechanical prophylaxis may also yield valuable insights. Ultimately, a personalized approach that considers individual patient risk profiles, surgical contexts, and preferences is essential for optimizing prophylactic strategies in orthopedic surgery. As the body of evidence continues to evolve, aspirin may emerge as a preferred alternative to enoxaparin, contingent upon further validation of its safety and efficacy in diverse clinical scenarios.

References

1. Agency for Healthcare Research and Quality. Operating Room Procedure During Hospitalization,2018. HCUP Statistical Brief #281. Available from https://hcup-us.ahrq.gov/reports/statbriefs/sb281-Operating-Room-Procedures-During-Hospitalization-2018.jsp Accessed [June 30 2024]

2. Fingar KR, Stocks C, Weiss AJ, Steiner CA. Most Frequent Operating Room Procedures Performed in U.S. Hospitals, 2003–2012. In: Healthcare Cost and Utilization Project (HCUP) Statistical Briefs. Rockville (MD): Agency for Healthcare Research and Quality (US); December 2014.

3. American Association of Hip and Knee surgeons. 2023 Hip and Knee Implant Review: A publication and online information service on cost and quality issues in orthopedics [Internet] Available from: https://www.aahks.org/wp-content/uploads/2023/10/onn343.pdf Accessed [June 30 2024]

4. marks julie. Blood Clots After Surgery [Internet]. WebMD. 2022. Available from: https://www.webmd.com/dvt/blood-clots-after-surgery Accessed [June 30 2024]

5. Blood Clots. Blood Clots in Orthopedic Surgery Fact Sheet [Internet]. Available from: https://www.stoptheclot.org/about-clots/toolkit-for-knee-hip-replacement-patients/orthopedic-surgery-fact-sheet/#:~:text=DVT%20is%20widely%20recognized%20as. Accessed [June 30 2024]

6. Akpinar EE, Hoşgün D, Akan B, Ateş C, Gülhan M. Does thromboprophylaxis prevent venous thromboembolism after major orthopedic surgery?. J Bras Pneumol. 2013;39(3):280-286. doi:10.1590/S1806-37132013000300004.x

7. Piovella F, Wang CJ, Lu H, et al. Deep-vein thrombosis rates after major orthopedic surgery in Asia. An epidemiological study based on postoperative screening with centrally adjudicated bilateral venography. J Thromb Haemost. 2005;3(12):2664-2670. doi:10.1111/j.1538-7836.2005.01621

8. Lee SY, Ro du H, Chung CY, et al. Incidence of deep vein thrombosis after major lower limb orthopedic surgery: analysis of a nationwide claim registry. Yonsei Med J. 2015;56(1):139-145. doi:10.3349/ymj.2015.56.1.139

9. MeSH | Cochrane Library [Internet]. www.cochranelibrary.com. Available from: https://www.cochranelibrary.com/advanced-search/mesh

10. MeSH | Cochrane Library [Internet]. www.cochranelibrary.com. Available from: https://www.cochranelibrary.com/advanced-search/mesh

11. Núñez JH, Moreira F, Escudero-Cisneros B, et al. Risk of venous thromboembolism in thromboprophylaxis between aspirin and low molecular weight heparins after total hip arthroplasty or total knee arthroplasty: Systematic review and meta-analysis. Riesgo de tromboembolismo venoso en la tromboprofilaxis entre aspirina y heparinas de bajo peso molecular tras una artroplastia total de cadera o artroplastia total de rodilla. Revisión sistemática y metaanálisis. Rev Esp Cir Ortop Traumatol. 2024;68(4):409-421. doi:10.1016/j.recot.2023.07.003.

12. Haac BE, O'Hara NN, Manson TT, et al. Aspirin versus low-molecular-weight heparin for venous thromboembolism prophylaxis in orthopaedic trauma patients: A patient-centered randomized controlled trial. PLoS One. 2020;15(8):e0235628. Published 2020 Aug 3. doi:10.1371/journal.pone.0235628.

13. Major Extremity Trauma Research Consortium (METRC), O'Toole RV, Stein DM, et al. Aspirin or Low-Molecular-Weight Heparin for Thromboprophylaxis after a Fracture. N Engl J Med. 2023;388(3):203-213. doi:10.1056/NEJMoa2205973.

14. Pretorius J, Nemat N, Azeem I, Shaju T, Nadeem S, Hammad Y. Is aspirin still relevant as a single pharmacological agent for venous thromboembolism prophylaxis post hip and knee arthroplasty surgery: A retrospective review. SICOT J. 2022;8:28. doi:10.1051/sicotj/2022029.

15. CRISTAL Study Group. Aspirin or enoxaparin for VTE prophylaxis after primary partial, total or revision hip or knee arthroplasty: A secondary analysis from the

CRISTAL cluster randomized trial. PLoS One. 2024;19(4):e0298152. Published 2024 Apr 16. doi:10.1371/journal.pone.0298152.

16. Zou Y, Tian S, Wang Y, Sun K. Administering aspirin, rivaroxaban and low-molecular-weight heparin to prevent deep venous thrombosis after total knee arthroplasty. Blood Coagul Fibrinolysis. 2014;25(7):660-664. doi:10.1097/MBC.0000000000000121.

17. Cortes-De la Fuente AA, Villalobos-Campuzano C, Bucio-Paticio B, Valencia-Martínez G, Martínez-Montiel O. Estudio comparativo entre enoxaparina y ácido acetilsalicílico en profilaxis antitrombótica para pacientes sometidos a artroplastía total de rodilla [Comparative study between enoxaparin and salicylic acetyl acid in antithrombotic prophylaxis for patients undergoing total knee arthroplasty]. Acta Ortop Mex. 2021;35(2):163-168..

18. Meng J, Liu W, Xiao Y, Tang H, Wu Y, Gao S. The role of aspirin versus low-molecular-weight heparin for venous thromboembolism prophylaxis after total knee arthroplasty: a meta-analysis of randomized controlled trials. Int J Surg. 2023;109(11):3648-3655. Published 2023 Nov 1. doi:10.1097/JS9.0000000000000656.

19. Singjie LC, Halomoan R, Saleh I, Sumargono E, Kholinne E. Clinical effectiveness and safety of aspirin and other anticoagulants for venous thromboembolism prophylaxis after major orthopedic surgery: a systematic review and meta-analysis of randomized clinical trials. EFORT Open Rev. 2022;7(12):792-799. Published 2022 Dec 21. doi:10.1530/EOR-22-0053.

20. Farey JE, An VVG, Sidhu V, Karunaratne S, Harris IA. Aspirin versus enoxaparin for the initial prevention of venous thromboembolism following elective arthroplasty of the hip or knee: A systematic review and meta-analysis. Orthop Traumatol Surg Res. 2021;107(1):102606. doi:10.1016/j.otsr.2020.04.002.

21. Wei Q, Sun J, Bai Y, et al. Aspirin versus LMWH for VTE prophylaxis after orthopedic surgery. Open Med (Wars). 2023;18(1):20230760. Published 2023 Aug 26. doi:10.1515/med-2023-0760

Aspirin Versus Enoxaparin for Deep Vein Thrombosis Prevention After Orthopedic Surgery: A Review of Efficacy and Safety

Sayed A Mahmud, Anura Manandhar,Ghadeer Sabir, Hala Abdeldady, Adoum Oumar Abakar, Ravindra Reddy Gangavarapu, Iana Malasevskaia

Email
sau.mahmud@gmail.com,
anuramanandhar@gmail.com,
ghadeersabir@hotmail.com,
h.alaaeddin95@gmail.com, adoum902@gmail.com,
qwertyreddy143@gmail.com,
iana.malasevscaia@gmail.com

Affiliation - California Institute of Behavioral Neurosciences and Psychology (CIBNP)