

Original Research Article

Does Aspirin Like Enoxaparin Effective to Reduce Thromboembolic Disease in Patients with Total Knee Arthroplasty Surgery?

Abstract

Background: Thromboembolic disease is a common complication among patients undergoing total hip and knee arthroplasty. There are a large number of clinical trials demonstrating the efficacy of aspirin and enoxaparin in preventing pulmonary emboli and deep venous thrombosis. This study aimed to investigate the preventive role of aspirin and enoxaparin after knee arthroplasty (TKA).

Methods: In this retrospective study, 160 patients undergoing knee arthroplasty at Imam Hossein Hospital, Tehran, Iran between January 2010 and February 2012 were studied. Patients were divided into treatment groups receiving enoxaparin and aspirin and were evaluated within 28 days after surgery. After examining demographic factors including age and sex, variables such as DVT, pulmonary embolus, infection, transfusion RBCs and mortality were evaluated.

Results: A total thrombosis rate of 0.0125% (one deep venous thrombosis) was observed. The two groups were not significantly different in the number of patients with complications such as DVT, pulmonary embolism, infection, average number of packed RBCs, and mortality.

Conclusion: We believe that course aspirin is as effective and safe as enoxaparin for thromboprophylaxis.

Keywords: thromboprophylaxis, total knee arthroplasty, aspirin, enoxaparin, VTE

Introduction

Venous thromboembolism (VTE) is a highly prevalent complication during and after hospitalization, as well as a serious contributor to surgery and unexpected deaths in hospitals [1]. Patients undergoing knee arthroplasty (TKA) and hip arthroplasty (THA) are at increased risk of VTE in the form of pulmonary embolism (PE) and deep vein thrombosis (DVT) [2]. An epidemiological trial showed that the prevalence of DVT after TKA, THA, and pelvic fracture surgery (HFS) without medicinal thromboprophylaxis was 41% in seven Asian countries [3]. Following major orthopedic surgery, increased blood coagulation may remain up to four weeks, while the risk of DVT may last for 3 months after operation [4, 5].

Given the increased incidence of VTE, the Scottish Intercollegiate Guidelines Network (SIGN, 2009), the UK-based National Institute for Health and Clinical Excellence (NICE, 2018), the American Academy of Orthopaedic Surgeons (AAOS, 2011), and the American College of Clinical Pharmacy (ACCP, 2012) suggest the consumption of low molecular weight heparin (LMWH) as a preferred factor to prevent thrombosis.

Most VTE happens in discharged patients and this has made it more important to evaluate the long-term prevention of the complication after major orthopedic surgery in patients. Preventive solutions, including compression devices and anticoagulants, are consumed to decrease the occurrence of VTE. Common anticoagulants include low molecular weight heparin (eg, enoxaparin sodium) and antiplatelets (eg, aspirin) [6].

Enoxaparin is parenteral heparin with a low molecular weight. The efficacy of enoxaparin in preventing DVT has illustrated in several clinical trials [7, 8]. However, there are safety concerns about bleeding and wound complications, and the exact treatment duration is under debate [9]. Compared with Xa inhibitors, enoxaparin results in higher rates of post-op anemia. European guidelines have remarked that postoperative thromboprophylaxis is necessary for those elderly patients who are able to consume oral anticoagulation as an effective and tolerable manner [10].

Acetylsalicylic acid, known as aspirin, has been supported by a large number of researchers and is one of the agents included in the AAOS guidelines [11]. The benefits of aspirin in preventing pulmonary emboli are shown in literature and regarded as a safe and less expensive regimen [12].

However, aspirin is not recommended by the ACCP due to the concerns regarding its efficacy in preventing PDV [13]. Historical data reflects the existing concerns regarding the consumption of

aspirin after arthroplasty for hip and knee [14]. More recently, studies using a combination of aspirin with new surgical techniques and multimodal protocols for thromboprophylaxis have reported considerably low rates of thromboembolic disorders [15].

According to the above, we investigated the effect of aspirin on enoxaparin over a 28-day period as an effective and safe means of chemical thromboprophylaxis.

Materials and Methods

Study Population

In this retrospective study, 160 patients undergoing knee arthroplasty at Imam Hossein Hospital, Tehran, Iran between January 2010 and February 2012 were studied.

Inclusion and Exclusion Criteria

In the present study, the inclusion criteria were patients with knee fracture diagnosed by CT and/or X-ray. Exclusion criteria in this study included patients consuming warfarin or those undergoing simultaneous bilateral arthroplasty procedures, patients who are diagnosed with malignancies, and those with a history of a bleeding disorder or major bleeding episodes such as intracranial or gastrointestinal bleeding, who require transfusion.

Treatment Protocol

All surgeries operations were conducted at a dedicated orthopedic hospital by an experienced arthroplasty surgeon. All patients were treated using mechanical calf compression devices. Physical therapy of patients was initiated on the day of surgery or one day after the operation in the afternoon. The general postoperative protocol was otherwise similar in all patients. Patient demographics are included in Table 1. Patients randomly divided into two groups. In group 1 Enoxaparin was begun on postoperative day 1 and 40 mg once daily and followed for 28 days. In the other group, patients received enteric-coated aspirin with a higher dose of aspirin (325 mg twice a day) for a period of 28 days. Follow-up care was carried out at 6 weeks and 6 months. Only symptomatic patients were investigated for pulmonary emboli or deep venous thrombosis. The records of patients were reviewed for any symptoms of infections, post-op transfusion requirements, pulmonary emboli, deep venous thrombosis, and re-admission during 6 months.

Patients with possible symptoms of pulmonary embolus or deep vein thrombosis were further investigated using a computed tomographic pulmonary embolus protocol scan or a duplex ultrasound of the symptomatic extremity. Patients who required antibiotic treatment or debridement without component exchange were defined as patients with superficial infections. On the other side, Patients with a need for irrigation or debridement with component exchange were defined as patients with deep infections.

Statistical Analysis

Data were analyzed using independent samples t-test and Fisher exact test in SPSS 19.0 software and presented as mean \pm standard deviation. P-values less than 0.05 ($P < 0.05$) were regarded to be statistically significant.

Results

The results of the present study were evaluated in 2 groups. In group 1, 80 cases were reviewed contain 57 men and 33 women with average of age 67.4 ± 8.4 years. Only 1 case (0.0125%) of deep venous thrombosis was documented. In the other 7 evaluated patients, no sign of pulmonary emboli or DVT was found. Moreover, 16 patients (20 %) were transfused packed red blood cells (RBCs).

In group 2, 80 cases were reviewed contain 54 men and 36 women with an average of age 63.1 ± 6.9 . Patient demographics are included in Table 1. In group 2 there were 1 (0.012%) deep venous thrombosis. 15(18.7%) patients were transfused packed RBCs. There were no infection and no deaths in two groups. Table 2 summarises the obtained data for each group and shows the resulted P values from the Fisher exact test. No significant difference was found in the range of DVT between the two groups ($P = 0.07$). Similarly, no significant difference was found between the two groups in terms of the number of patients having complications such as infection, pulmonary embolism, the average number of packed RBCs, and mortality.

Table 1. the demographic patient's data

Variable	Group 1	Group2	P-value
age	67.4±8.4 (52-82)	63.1±6.9 (59-79)	0.087
gender	57 (71.25%)men	54 (67.5%)men	0.092

Table 2. Comparison of two groups in terms of variables of bleeding, embolism, and death

Variable	Group 1(N)	Group 2(N)	P-value
DVT	1	1	0.07
Pulmonary embolus	0	0	1
Infection	0	0	1
Transfusion RBCs	16	15	0.55
Death	0	0	1

Discussion

Thromboembolic disease is a common complication among patients undergoing total hip and knee arthroplasty. There is controversy in the exact prevalence of pulmonary emboli and deep venous thrombosis. Prevalence rates over 50% are reported in the absence of prophylaxis [13]. This rate has significantly decreased with the aid of new joint protocols that use early mobilization, modified anesthetic techniques, and mechanical compression devices [16]. Recently, Dorr et al [17] performed a review of 1179 cases in which they used a multimodal approach to prevent thrombosis. They reported an incidence rate of 0.25% for pulmonary emboli and 5.2% for deep venous thrombosis of which only 0.4% were clinically symptomatic. Even non-chemical prophylaxis protocols have resulted in thrombosis rates below 5% [18, 19]. Oster et al by reviewing data recorded in US databases stated that 2.2% of patients undergoing major orthopedic surgeries, develop thromboembolism within the first 90 days after being hospitalized. They reported that 60% of these patients had this problem after discharge [20]. Thus, the use of a suitable thromboprophylaxis method seems necessary. Despite the numerous drugs that have been introduced for this purpose, there is still controversy over the choice of a drug with higher efficacy and fewer side effects [21].

In the present study, the safety and efficacy of enoxaparin and aspirin were evaluated in prevention of VTE after TKA. Our results showed that there was no difference between the two drugs mentioned in reducing DVT, pulmonary embolism, infection, blood transfusion, and mortality.

Enoxaparin is an LMWH with rapid antithrombotic action, linear pharmacokinetics, and limited variable effects [22]. Both of the AAOS and ACCP have supported enoxaparin to be used as chemical thromboprophylaxis after arthroplasty of hip and knee [13]. The use of enoxaparin is also approved by almost all oversight groups including the Surgical Care Improvement Project [23]. However, there are concerns about the safety of this drug, and some complications such as bleeding and wounds have increasingly been noticed by some centers attempting to adhere the ACCP guidelines [24]. Furthermore, there is controversy regarding the exact treatment duration with enoxaparin. While the AAOS has suggested a treatment course of 7 to 10 days, the ACCP recommends a longer course of 28 to 35 days. It is shown that prolonged dose treatment results in reduced rate of geographically documented thromboembolism. However, it remained unclear if this produces any clinical improvements or cost-reducing [25, 26].

Using LMWH for prevention of VTE can be equiponderant regarding the weight, and reduce the bleeding after operation. Although more cases of VTE occurred, no mortal pulmonary embolism happened in this study, which is comparable with the results by Fisher [27] and Eriksson [28] and is more desirable than the results by Anderson with one fatal PE. The prophylaxis anticoagulation project delivered in this study was both the safe and effective.

Aspirin has numerous advantages, particularly in outpatient settings. It is such a well-tolerated and inexpensive drug and has a few side effects. The efficacy of aspirin has been demonstrated, especially when used as a part of a multimodal approach [11]. Isolated use of aspirin is not suggested by the ACCP, as a high rate of thromboembolic conditions have been reported in the older literature [13, 14].

The use of a short-term aggressive inpatient-only anticoagulation regimen is well documented in previous literature, where the average length of stay with such regimens has declared to be 7 to 10 days [29]. These protocols must be adapted since they decrease the length of stay. In this study, no difference was found in terms of post-op complications. Both the pulmonary emboli and symptomatic deep venous thrombosis were noted only in one patient (0.012%). The results for the rates of infection, bleeding, and symptomatic thrombosis was similar to another group with a 28-days aspirin course. This pilot study was performed to evaluate our thromboprophylaxis protocol. Given the fact that this study is a retrospective review, criticisms toward such a study design are possible. There was no routine monitoring for venous thrombosis, but symptomatic patients were investigated for possible thromboembolic conditions [30]. Owing to the low cases of fatal pulmonary embolus in patients after arthroplasty, it is not possible to compare the mortality rates from pulmonary emboli between the groups. According to AAOS, a demonstration of 50% reduction in the mortality of pulmonary embolus among two groups requires the randomization of 30000 patients. Performing such a study would be cost-prohibitive [31]. The strength points of the present study are that it was unfunded, and addresses the major concerns of arthroplasty surgeons regarding symptomatic thrombosis, bleeding, and infection.

Overall, the protocol proposed in this study was effective and safe in patients with a normal risk after arthroplasty of the knee. Moreover, it resulted in low rates of symptomatic thromboembolic cases when combined with early mobilization and mechanical compression devices. Its use resulted in a significant low complication rate and considerable cost savings.

Conclusion

Our results show that both aspirin and enoxaparin are effective in reducing venous thrombosis in TKA patients. We found that aspirin may be a safe, inexpensive, convenient, and effective alternative to long-term prevention after TKA. We recommend randomized controlled trials with large-sample, prospective, double-blind in order to perform aspirin efficacy and safety.

Conflict of interest

None

References

1. Association CO. Prevention of venous thromboembolism after major orthopedic surgery. *Orthopedic Surgery*. 2010;2(2):81.
2. White RH, Henderson MC. Risk factors for venous thromboembolism after total hip and knee replacement surgery. *Current Opinion Pulmonary Med* 2002;8(5):365-71.
3. Piovella F, Wang CJ, Lu H, Lee K, Lee L, Lee W, 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 Thrombosis Haemostasis*. 2005;3(12):2664-70.
4. Anderson DR, Dunbar M, Murnaghan J, Kahn SR, Gross P, Forsythe M, et al. Aspirin or rivaroxaban for VTE prophylaxis after hip or knee arthroplasty. *New England J Med* 2018;378(8):699-707.
5. Eriksson BI, Borris LC, Friedman RJ, Haas S, Huisman MV, Kakkar AK, et al. Oral Rivaroxaban Compared with Subcutaneous Enoxaparin for Extended Thromboprophylaxis after Total Hip Arthroplasty: The RECORD1 Trial. *Am Soc Hematology*; 2007.
6. Huang Q, Xing Sx, Zeng Y, Si Hb, Zhou Zk, Shen B. Comparison of the Efficacy and Safety of Aspirin and Rivaroxaban Following Enoxaparin Treatment for Prevention of Venous Thromboembolism after Hip Fracture Surgery. *Orthopaedic surgery*. 2019;11(5):886-94.
7. Skedgel C, Goeree R, Pleasance S, Thompson K, O'brien B, Anderson D. The cost-effectiveness of extended-duration antithrombotic prophylaxis after total hip arthroplasty. *JBJS*. 2007;89(4):819-28.
8. Huo MH, Stuckey R. Thromboembolism after total hip arthroplasty. *Current Opinion Orthopaedics*. 2005;16(1):25-8.
9. Spiro TE, Friedman RJ, Whitsett TL, Johnson GJ, Gardiner GA, Landon GC, et al. Prolonged enoxaparin therapy to prevent venous thromboembolism after primary hip or knee replacement. *JBJS*. 2001;83(3):336.
10. Kozek-Langenecker S, Fenger-Eriksen C, Thienpont E, Barauskas G. European guidelines on perioperative venous thromboembolism prophylaxis: Surgery in the elderly. *European J Anaesthesiol (EJA)*. 2018;35(2):116-22.

11. Bozic KJ, Vail TP, Pekow PS, Maselli JH, Lindenauer PK, Auerbach AD. Does aspirin have a role in venous thromboembolism prophylaxis in total knee arthroplasty patients? *J Arthr.* 2010;25(7):1053-60.
12. Prevention PE. Trial Collaborative Group. Prevention of pulmonary embolism and deep vein thrombosis with low dose aspirin: Pulmonary Embolism Prevention (PEP) trial *Lancet.* 2000;355(9212):1295-302.
13. Geerts WH, Bergqvist D, Pineo GF, Heit JA, Samama CM, Lassen MR, et al. Prevention of venous thromboembolism: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest.* 2008;133(6):381S-453S.
14. McKenna R, Galante J, Bachmann F, Wallace D, Kaushal P, Meredith P. Prevention of venous thromboembolism after total knee replacement by high-dose aspirin or intermittent calf and thigh compression. *Br Med J.* 1980;280(6213):514-7.
15. Lachiewicz PF, Soileau ES. Mechanical calf compression and aspirin prophylaxis for total knee arthroplasty. *Clinical Orthopaedics Related Res.* 2007;464:61-4.
16. Moningi S, Patki A, Padhy N, Ramachandran G. Enhanced recovery after surgery: An anesthesiologist's perspective. *J Anaesthesiol Clin Pharmacol.* 2019;35(Suppl 1):S5.
17. Dorr LD, Gendelman V, Maheshwari AV, Boutary M, Wan Z, Long WT. Multimodal thromboprophylaxis for total hip and knee arthroplasty based on risk assessment. *JBJS.* 2007;89(12):2648-57.
18. Sugano N, Miki H, Nakamura N, Aihara M, Yamamoto K, Ohzono K. Clinical efficacy of mechanical thromboprophylaxis without anticoagulant drugs for elective hip surgery in an Asian population. *The Journal of arthroplasty.* 2009;24(8):1254-7.
19. Colwell Jr CW, Froimson MI, Mont MA, Ritter MA, Trousdale RT, Buehler KC, et al. Thrombosis prevention after total hip arthroplasty: a prospective, randomized trial comparing a mobile compression device with low-molecular-weight heparin. *JBJS.* 2010;92(3):527-35.
20. Oster G, Ollendorf DA, Vera-Llonch M, Hagiwara M, Berger A, Edelsberg J. Economic consequences of venous thromboembolism following major orthopedic surgery. *Annals Pharmacotherapy.* 2004;38(3):377-82.
21. Rachidi S, Aldin ES, Greenberg C, Sachs B, Streiff M, Zeidan AM. The use of novel oral anticoagulants for thromboprophylaxis after elective major orthopedic surgery. *Expert Revi Hematol.* 2013;6(6):677-95.
22. Haas SB, Barrack RL, Westrich G, Lachiewicz PF. Venous thromboembolic disease after total hip and knee arthroplasty. *JBJS.* 2008;90(12):2764-80.
23. Bratzler DW. Development of national performance measures on the prevention and treatment of venous thromboembolism. *J Thrombosis Thrombolysis.* 2010;29(2):148-54.
24. Novicoff WM, Brown TE, Cui Q, Mihalko WM, Slone HS, Saleh KJ. Mandated venous thromboembolism prophylaxis: possible adverse outcomes. *J Arthroplasty.* 2008;23(6):15-9.
25. Eikelboom JW, Quinlan DJ, Douketis JD. Extended-duration prophylaxis against venous thromboembolism after total hip or knee replacement: a meta-analysis of the randomised trials. *The Lancet.* 2001;358(9275):9-15.
26. McAndrew CM, Fitzgerald SJ, Kraay MJ, Goldberg VM. Incidence of postthrombotic syndrome in patients undergoing primary total knee arthroplasty for osteoarthritis. *Clin Orthopaedics Related Res* 2010;468(1):178-81.

27. Fisher W, Agnelli G, George D, Kakkar A, Lassen M, Mismetti P, et al. Extended venous thromboembolism prophylaxis in patients undergoing hip fracture surgery—the SAVE-HIP3 study. *Bone Joint J.* 2013;95(4):459-66.
28. Eriksson BI, Lassen MR. Duration of prophylaxis against venous thromboembolism with fondaparinux after hip fracture surgery: a multicenter, randomized, placebo-controlled, double-blind study. *Archives Internal Med.* 2003;163(11):1337-42.
29. Larsen K, Hansen TB, Thomsen PB, Christiansen T, Søballe K. Cost-effectiveness of accelerated perioperative care and rehabilitation after total hip and knee arthroplasty. *JBJS.* 2009;91(4):761-72.
30. Dhupar S, Iorio R, Healy WL, Dhimitri K. A comparison of discharge and two-week duplex ultrasound screening protocols for deep venous thrombosis detection following primary total joint arthroplasty. *JBJS.* 2006;88(11):2380-5.
31. Surgeons AAoO. American Academy of Orthopaedic Surgeons clinical guideline on prevention of symptomatic pulmonary embolism in patients undergoing total hip or knee arthroplasty. http://www.aaos.org/Research/guidelines/PE_guideline.pdf. 2007.

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