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REVIEW ARTICLE

A Sole Thromboprophylactic in Prescription of Postoperative Orthopedic Patients – A Review

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ABSTRACT

Background: Venous thromboembolism (VTE) is one of the most well-known and feared sequelae of orthopaedic surgery. VTE is relatively common after arthroplasty, prophylaxis has been prescribed. The frequency of postoperative thromboembolic events increased in the absence of primary prevention. Following operations, immobilisation of a lower limb that restricts calf muscle contraction has been shown to be a key risk factor for VTE. VTE is the most frequent source of readmission in orthopaedic patients who have undergone major procedures. It should be emphasized that the best mechanical method for preventing VTE is early walking. Medication for VTE prophylaxis is prescribed more often than mechanical prophylaxis. After major orthopaedic surgery, anticoagulant treatment is essential for reducing morbidity and death. Following hospital discharge, prophylactic drug therapy aims to reduce the morbidity and mortality episodes associated with DVT and PE occurrences. Aspirin use for prevention of VTE following THA and TKA has gained popularity, especially among orthopaedic surgeons due to a minimal risk of postoperative haemorrhage, it also reduces the incidence of recurrent DVTs.

Conclusion: Due to its low cost and easy administration without the requirement for regular blood testing, aspirin thromboprophylaxis following knee surgery appears promising. Aspirin saved more QALYs and was cost-effective. Aspirin was demonstrated to have a higher VTE prophylaxis profile than other medications with a time-related association to early mobilisation, healthier patients and medication compliance.

Keywords: Thromboprophylaxis, Immobilisation, Orthopaedic surgery, Aggregation of platelets, Cost effectiveness.
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INTRODUCTION

Total knee and hip replacements are common and effective preventative measures for degenerative joint conditions including osteoarthritis. After knee or hip arthroplasty, venous thromboembolism (VTE); deep vein thrombosis (DVT) and pulmonary embolism (PE) occurs more frequently than 10% of the population.[1]

With regular thromboprophylaxis medications, this can be decreased to 1 to 10%. It has been documented that the rates of Deep Venous Thrombosis (DVT) for Total Hip Arthroplasty (THA) and Total Knee Arthroplasty (TKA) correspondingly can reach 40 to 60% and 40 to 85% respectively in the absence of thromboprophylaxis.[2]

Recent research has revealed that significant non-cardiac procedures are also linked to a transiently elevated risk of arterial thrombosis including myocardial infarction and stroke.[3] An increased risk of surgical site infection (SSI) has been linked to postoperative hematoma development.[4] A stroke may make THA or TKA more challenging. Within the first year following surgery 25% of patients who experienced a stroke died unexpectedly.[3]

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This article discusses about Deep Vein Thrombosis and its associated risk factors as well as better ways to reduce this risk by using prophylaxis with a single medicine that is preferable for lower the risk of patients recovering from orthopaedic surgery.

Deep Vein Thrombosis (DVT)

One of the most well-known and dreaded side effects of orthopaedic surgery is venous thromboembolism (VTE) which is the primary factor in unnecessary hospital deaths. Deep vein thrombosis (DVT) and pulmonary thromboembolism (PTE) are commonly develops.[5] The first adverse event on this list is regarded as the most prevalent and the main cause of death in the initial three months following surgery. The majority of pulmonary embolism related deaths particularly those that occur suddenly are caused by DVT.[6]

VTE is a threat for more than half of all hospitalised patients and it is higher for surgical patients than for medical management patients. In general, hospitalised patients undergoing medical or general surgery experience a deep vein thrombosis incidence of 10% to 40% by contrast, major orthopaedic surgery patients experience a DVT incidence of up to 40% to 60%.[7] VTE continues to be a problem and a significant potential concern during the perioperative period.[8] VTE may develop in more than 35% of people undergoing arthroplastys without prophylaxis in that most of the people don't experience any symptoms.[3]

In the absence of prophylactic therapy, the probability of postoperative thromboembolic events was calculated to be roughly 50% for an asymptomatic event and 15% to 30% for a symptomatic event.[9] Within 30 days of surgery, the total VTE rates for THA and TKA were 0.6% and 1.4% respectively.[2] Prophylaxis has been recommended following arthroplasty due to the relatively high incidence of VTE.[3]

Mechanism of DVT

The Virchow triad, which includes endothelial impairment, venous stasis and hypercoagulability can promote thrombosis to form. Lower limb arthroplasty involves all three elements. A venous thrombus frequently begins to form in the area of a valve where the blood flow pattern changes and endothelial dysfunction occurs. Hypoxia caused by stagnant blood in a straight portion of the blood artery triggers thrombogenesis and the aggregation of platelets.[3] There is growing recognition that VTE typically does not develop in the absence of the pathophysiologic mechanisms identified in Virchow's triad in 1884.[7]

All of the Virchow's triad's pathophysiologic processes are present in an orthopaedic patient undergoing surgery: The following elements affect to venous blood stasis: the use of tourniquets, immobilisation and bed rest; surgical manipulations of the limb; an increase in thromboplastin agents; trauma and the use of polymethylmethacrylate (PMMA) bone cement. VTE prophylaxis and adherence to the appropriate recommendations are therefore important in patients having orthopaedic surgery and those who have undergone orthopaedic trauma.[7]

Risk Factor of DVT

The risk of developing thromboembolism is increased by a number of factors including family history, advanced age, cardiomyopathies, chronic edema of the lower limbs, immobility, obesity, sedentary lifestyle, use of medication (oral contraceptives or hormones), excessive blood loss and transfusion among others.[6]

Strong risk factors for VTE include fractures of the hip or leg, hip or knee replacement, major general surgery, major trauma and spinal cord injury (SCI); Moderate risk factors include arthroscopic knee surgery, central venous catheters, chemotherapy, congestive heart failure or respiratory failure, hormone replacement therapy, malignancy, oral contraceptive therapy, paralytic stroke, pregnancy/postpartum, previous VTE; Weak risk factors include bed rest lasting longer than three days, being bedridden, getting older, having laparoscopic surgery, being obese, pregnant and having varicose veins.[7]

Orthopedic surgeries carry a substantial risk of VTE, especially large hip and knee operations. In addition, the absence of ground support for the lower leg is linked to a higher chance of developing VTE which together with immobility constitutes a significant risk factor. After procedures below the level of the knee, immobilisation of a lower limb limit the contraction of the calf muscles has been demonstrated to be a major single risk factor for VTE. Additionally, it is well-known that the chance of getting VTE increases with the length of immobilisation.[5]

In comparison to immobilisation for a shorter amount of time, immobilisation without support for 2 to 8 weeks is correlated to a 9-fold increased chance of having VTE (odds ratio: 95% of Confidential interval).[5] Some of the conditions with the highest scores included hypercoagulability, metastatic cancer, stroke, sepsis and chronic obstructive pulmonary disease. Any of these disorders increased the probability of post-operative VTE in patients by more than 3%.[3]

Developing Period of DVT

According to a recent study, 94% of symptomatic VTEs happen within two weeks of an arthroplasty with 89% happening in the first week.[3] 29% of thrombi begin in the first 12 days after surgery and 23% in the 22–24 day postoperative interval, there is a higher risk of developing this condition in the second and third weeks.[6]

While venous function might continue to be considerably compromised for up to 42 days after hip

fracture surgery, hypercoagulability can last for six weeks after a hip fracture. The most prevalent reason for readmission following total hip replacement is VTE, which can develop up to three months after total knee and hip arthroplasty.[7]

Prophylaxis of DVT

Routine mechanical and chemical prophylaxis has helped to reduce the occurrence of VTE.[8]

Mechanical Propylaxis

In order to support venous return, mechanical thromboprophylaxis relies on progressive muscle compression over veins. Mechanical thromboprophylaxis can be carried out during orthopaedic procedures with the use of elastic compression stockings and intermittent pneumatic compression devices (IPCDs).[5] The use of elastic compression stockings for mechanical prophylaxis can minimise the occurrence of DVT by more than 50%.[6] These devices have the benefit of not having the adverse effects of anticoagulant medications such as bleeding.[5]

Early walking to mobilization is likely the most practical and simplest approach of VTE prevention.[7] Early patient movement in conjunction with intermittent pneumatic compression is thus a useful strategy for preventing VTE significantly reducing on hospital stays as well as decreasing other adverse affects.[6] Post-THR symptomatic VTE has been linked to a reduced prevalence of early walking.[7] It should be mentioned that early walking is the most effective mechanical strategy for VTE prevention.[5]

More frequently than mechanical prophylaxis, medications for VTE prophylaxis (pharmacological prophylaxis) are used after ankle and foot procedures. This is impacted due to the higher cost and less widespread use of compression devices and stockings.[5]

Pharmacological Prophylaxis

Despite the issues that were briefly discussed, anticoagulant therapy is crucial for preventing morbidity and mortality incidents related to THR and TKR surgery.[10] After major orthopaedic surgery anticoagulants are frequently used and advised to prevent VTE. When used as a preventative measure anticoagulants have been reported to reduce the risk of thromboembolic events by around 50% to 80%.[9]

Regardless of the existence of VTE prophylaxis recommendations in the early 2000s, limited VTE prophylaxis was used. Currently, it appears to be increasing in hospitals are following to American College of Clinical Pharmacy (ACCP) recommendations, especially for orthopaedic patients.[7] Antithrombotic prophylaxis is advised following THR or TKR according to the American College of Chest Physicians (ACCP) and American Association of Orthopedic Surgeons (AAOS) recommendations for VTE prevention.[9] Most guidelines encourage using thromboprophylaxis after major orthopaedic surgery and it is generally seen as the gold standard.[11]

The use of aspirin, low-molecular-weight heparins (LMWH), vitamin K antagonists (such as Warfarin) or indirect factor Xa inhibitors is suggested by current thromboprophylaxis guidelines. There are currently novel oral anticoagulants (NOAC) available for prophylaxis against VTE in patients following TKR or THR surgery including Dabigatran, Etexilate, Ximelagatran, Rivaroxaban and Apixaban.[9]

The goal of prophylactic medication therapy following hospital discharge is to lower the morbidity and mortality incidents related to DVT and PE occurrences. Depending on the patient's risk factors, this prophylactic medication treatment may be used up to 3-6 months following the hospital discharge.[10]

Benefits and Challenges of Anticoagulants

The use of more potent drugs that are attributed to a higher incidence of bleeding and wound-related problems, like the recently introduced oral drugs and LMWH.[3] When compared to those who were not taking NOACs, bleeding risk increased. However, the hip and knee arthroplasty population is where the novel anticoagulants have the most efficacy.[1]

Patients find it hard to take the conventional injectable medication LMWH once they are discharged.[1] Numerous studies have revealed that LMWH raises the probability of both minor and serious haemorrhage.[3] Parenteral administration, cost, the possibility for thrombocytopenia and poor patient adherence are drawbacks of LMWH. These medicines cost a lot of money.[9]

Warfarin, a common oral anticoagulant has a limited therapeutic window and several medication interactions making it challenging to manage in clinical settings.[1] With the least risk of bleeding, aspirin offered equivalent VTE prophylaxis to factor Xa inhibitors and superior VTE prophylaxis to enoxaparin and warfarin.[8] Following arthroplasty, patients taking warfarin for VTE prevention experienced a six-fold increase in the incidence of PE compared to those taking aspirin. Recent research has found that people consuming aspirin instead of warfarin have a decreased rate of mortality during arthroplasty.[3] Aspirin is the most suitable medication for thromboprophylaxis in all TKA patients including those receiving simultaneous bilateral total knee arthroplasty (SBTKA) and is more efficient than warfarin.[12]

Aspirin administration for the prevention of VTE may potentially result in some unanticipated positive effects.[3] Due to a low risk of postoperative haemorrhage aspirin use for prevention of VTE following THA and TKA has grown in favour especially among orthopaedic surgeons. The American College of Chest Physicians (ACCP) and the American Academy of Orthopedic Surgeons (AAOS) both support the use of aspirin-only regimens for the prevention of postoperative VTE.[13]

After then, low-risk people are advised to take aspirin. Aspirin is therefore given to many patients in the United States having joint replacement surgery as an antithrombotic in postoperative VTE prevention. Most of the evidence for this approach comes from retrospective studies that claim aspirin may not be inferior to anticoagulants when used as prophylaxis. A 1.7% risk of symptomatic VTE in a low-risk population taking aspirin alone after TKA is acceptable in this era, it is simpler, effective anticoagulants with a low risk of bleeding for VTE prevention following joint replacement surgery.[13]

Aspirin is the Effective Prophylaxis

Acetylsalicylic acid more commonly known as aspirin, is a medication used to prevent VTE after arthroplasty. Numerous trials have proven its effectiveness in reducing VTE after arthroplasty.[3] Acetylsalicylic acid prevents cyclooxygenase from producing prostaglandins and thromboxane which prevents platelet aggregation. It is a widely used medicine that is both affordable and conveniently accessible.[5]

Aspirin has been demonstrated to lower the risk of reoccurring DVTs. Aspirin's effectiveness in preventing VTE extends to its capacity to lower the frequency of both proximal and distal DVTs. According to a recent comprehensive analysis, aspirin is more effective than other anticoagulants at preventing arterial thrombosis following THA and TKA. Aspirin's anti-inflammatory properties may also aid in better pain management and lessened narcotic usage. Anti-inflammatory characteristics of aspirin may contribute to a decreased risk of wound-related complications and in further surgery.[3]

Low dose aspirin should be administered to prevent VTE after arthroplasty, showed that platelet COX-1 function can be inhibited by aspirin at dosages of 30 to 150 mg. It may also make sense to take extended prophylaxis especially in high-risk patients who are less mobile.[3] Following the Health Service Executive (HSE) recommendations, take 150 mg of aspirin once daily for 4 weeks. In THA and TKA patients, a low dose of aspirin (81 mg) achieved results comparable to those of a large dose of aspirin (325 mg).[2] In comparison to patients who got anticoagulants, patients who simply took aspirin did not have an increased chance of developing another VTE.[14]

Aspirin was suggested as a feasible pharmacological treatment for VTE prophylaxis in the 2007 American Association of Orthopaedic Surgery (AAOS) guidelines for patients at low risk for VTE. The use of aspirin alone as VTE prevention was categorically discouraged by ACCP guidelines in 2008 for any patient population, including orthopaedic patients. However, the 2012 ACCP guidelines do advise using aspirin as a VTE prophylaxis for patients having THR, TKR or hip fracture surgery because it seems that taking it was more efficacious than using a placebo in these patients.[7]

The dosage and duration of aspirin administration for VTE prophylaxis are still unknown, according to a meta-analysis from 2016, even though aspirin is an appropriate medication for the prevention of VTE in THR and TKR and is advised by the ACCP and AAOS. [7] Aspirin is now the primary method for VTE prophylaxis after arthroplasty in North America which represents a significant shift in recent years.[3]

Aspirin is the primary prophylactic given to patients getting hip or knee replacement surgery.[3] The use of aspirin as a preventive medication is widespread for a number of reasons. In addition to its demonstrated efficacy, it is also cost effective, well tolerated and its use does not necessitate routine blood testing. Another reason for the switch towards aspirin may be due to the cost of arthroplasty. It is a "milder" drug that is less prone to cause the formation of a bleeding. Healthcare providers may be required to cover the costs of complications and readmissions due to cost-containment measures which encourages strategies that also sensitise the orthopaedic community. The use of less aggressive VTE prophylaxes like aspirin that reduce the risk of this complications.[3] In almost all common orthopaedic procedures, it is safe to continue taking aspirin after surgery.[7]

Aspirin's Mechanism of Action

Aspirin is a widely studied antithrombotic drug that permanently reduces platelet cyclooxygenase (COX) activity. The mechanism for the metabolism of arachidonic acid depends on COX-1. By acetylating a serine residue in cyclooxygenase-1(COX-1), aspirin permanently prevents platelet aggregation. Arachidonic acid is converted by this enzyme to prostaglandin (PG) H2, which in turn produces thromboxane A2 (TXA2) and PGI2. The COX-1 enzyme is kept inactive and its catalytic site is blocked by acetylation of the serine residue.[3,15] Generally, TXA2

causes vasoconstriction, while PGI2 causes vasodilation. Aspirin works by inhibiting COX-1, which then prevents the synthesis of TXA2 and prevents platelet aggregation. Aspirin can stop platelets from adhering together and depositing in the subendothelial space.[3] This antiplatelet impact lasts for the 7–10 days, platelets can no longer combine as a result.[15]

Numerous modes of action have been hypothesised for the antithrombotic effects of aspirin in VTE prophylaxis, in addition to COX-1 inhibition. Through non-cyclooxygenase-1 mechanisms, it prevents the activation and aggregation of platelets. Additionally, it reduces the expression of tissue factors on monocytes and macrophages, impairs the formation of prothrombinase on platelets with decreased factor V activation and attenuates the production of thrombin by acetylating antithrombin III and prothrombin. Aspirin inhibits the activation of thrombin-mediated factor XIII and acetylates fibrinogen and fibrin causing the production of looser fibrin networks with higher lysability.[3]

Additional Benifits of Aspirin

Following orthopaedic surgery, aspirin is now more frequently used prophylactically according to the ACCP guideline's recent recommendation of aspirin. Its low cost and easy oral administration without the requirement for frequent blood monitoring are potential benefits.[11] Aspirin is one of the most efficient, affordable and secure approaches for VTE prophylaxis following arthroplasty including those with a hip fracture. Aspirin use has additional advantages, such as a decreased risk of myocardial infarction and is linked to a significantly lower incidence of problems. Aspirin's capacity to stop arterial thrombosis which causes myocardial infarction and stroke, that's what gives it its positive effects.[3] According to other research, aspirin use for VTE prophylaxis is attributed to a decreased mortality risk from cardiac-related causes.[16]

Patients taking aspirin had no bleeding, infection or mortality, but did have low but reduced chances of bruising and lower extremities edema. From this viewpoint, aspirin is a desirable agent because it is an oral drug that may be used once daily.[16] Aspirin prophylaxis lasted from around five days to six weeks. It is yet unknown how long prophylaxis should last after knee surgery.[11]

Duration of Aspirin Administeration

When the treated lower limb is supported or when the immobilisation is removed, even without assistance, prophylaxis may be stopped, allowing the active contraction of the calf muscles and lowering the chance of developing VTE.[5] Although the ideal prophylactic dosage and duration are yet known.[3]

Adverese Effects of Aspirin

In comparison to other chemical agents available for VTE prophylaxis, aspirin seems to be less dangerous and to have fewer adverse effects. Aspirin use rarely results in adverse effects such as dyspepsia, gastroesophageal reflux and an elevated risk of upper gastrointestinal haemorrhage can all be caused by it especially at larger doses.[3] This was also observed by the Extended Prophylaxis Comparing Low-Molecular-Weight Heparin to Aspirin in Total Hip Arthroplasty (EPCAT)- I experiment, when it was discovered that aspirin had a lower rate of bleeding risk than LMWH. According to various studies, people using aspirin after total joint arthroplasty have a minimal risk of bleeding.[2] Patients should stop taking aspirin if they experience any negative side effects from using it.[3]

Cost Effectiveness of Aspirin

The actual costs of administering potent anticoagulants are significantly higher when one takes into account the elevated risk of wound-related problems, haematoma formation and subsequent deep infection. Aspirin is cheaper, it lowers both the direct and indirect costs of VTE prophylaxis, reducing the length of hospital stay, PE occurrence and other VTE-related problems. Compared the impact of aspirin and LMWH on the knee's early return to movement following TKA and revealed that aspirin had a faster rate of return. Aspirin does not require blood testing unlike Warfarin, which may cause a hospital stay to extend until the target therapeutic levels are reached. An early hospital discharge for the patients who taking aspirin as a prophylaxis. Aspirin was cost-effective and saved more Quality-Adjusted Life-Year (QALY) than warfarin in all age categories, according to a recent cost-effectiveness research comparing their usage following arthroplasty. For patients with no prior history of VTE following THA and those who are older than 80 years following TKA, aspirin usage proved cost-effective.[3]

Without the use of Prophylaxis

Orthopaedic patients are at the highest risk, according to a risk assessment of the chance for VTE in surgical patients without prophylaxis. In patients who did not get any VTE prophylaxis, the incidence of venographic verified DVT and proximal DVT 7 to 14 days following major orthopaedic surgery are roughly 40% to 60% and 10% to 30% respectively. These orthopaedic patients are still at risk for VTE after leaving the hospital. Fatal PE is rare in orthopaedic patients using routine VTE prophylaxis and rates of symptomatic VTE after three months have dropped to 1.3% to 10%.[7]

CONCLUSION

Each agent has both advantages and disadvantages. If a pharmacological drug satisfies the following requirements 1) high efficacy in VTE prevention, 2) low risk of bleeding, 3) ease of administration, 4) cost-effectiveness and 5) minimised postoperative complications; it might be regarded as an appropriate therapy option. Comparing patients who received any prophylactic anticoagulant medication to those that only took aspirin, postoperative venous thromboembolism was not associated with a greater risk in the aspirin-only group. Because of its time-related correlation with early mobilisation, healthier patients and medication compliance, aspirin was found to have a greater VTE prophylaxis profile than other drugs. Recommend oral aspirin among the strongest antithrombotic agent for patients who aren't deemed to be at "high risk" for postoperative VTE. Concurrently, as more research points to the safety and effectiveness of aspirin as a preventative medication, so its use has improved. The use of aspirin in certain people is linked to a low incidence of adverse effects and may have additional advantages, such as a decrease in the rate of myocardial infarction. Aspirin prevents ischemic cardiovascular and cerebrovascular disease well.

Aspirin has recently been endorsed for usage as the only thromboprophylactic drug following knee or hip arthroplasty. In some patients, postoperative thromboprophylaxis with aspirin alone may be a safe approach. Due to its inexpensive cost, proven efficacy and therapeutic familiarity, aspirin is a preferred option.

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