

Best Practice for Deep Vein Thrombosis Prevention: A Research Review

Pamela Dusseau

Carly Macklin

Natalie Russell

Danielle Williams

Ferris State University

NURS 350

Abstract

It is standard practice for the adult postoperative patient to be treated prophylactically for the risk of deep vein thrombosis formation after a surgical procedure. This is often done with a regimen of mechanical compression (TED hose, graduated compression stockings, pneumatic compression devices) or a subcutaneous anticoagulant medication. A commonplace intervention, postoperative leg stockings or subcutaneous and/or oral anticoagulants are often an issue of protest and dissatisfaction with patients. While a combination of the two are often ordered, the Registered Nurses authoring this report have witnessed the implementation of singular therapies, leading them to question which method provides the best prevention against thrombosis prevention. With a review and critique of the best found research literature of this topic and recommendations for utilization for evidenced based practice, the author's report their findings.

Best Practice for Thrombosis Prevention: A Research Review

The deep vein thrombosis (DVT) has been found to be a common complication for post-surgical patients that do not receive prophylactic treatment. A study by Eppsteiner, Shin, Johnson & van Dam (2010) state “The risk of postoperative venous thromboembolic disease is as high as 30%, with an associated fatality risk of 1%.” With such a high incidence of complication rates, it is crucial that health care facilities remain knowledgeable on the most current evidence based research available regarding DVT prevention practices and emphasize that DVT’s are not just a minor inconvenience to patients trying to recover from major surgeries. With such a high incidence of complication rates, it is crucial that health care facilities be knowledgeable on the most current evidence based research available regarding DVT prevention practices.

Standard practice currently provides the patient with either one or a combination of oral or subcutaneous anticoagulation and/or mechanical compression regimen. Given the seriousness of this issue, a study was completed to find and analyze literature that has examined these preventative measures. Specifically, the authors sought to answer the question: what is the effect of subcutaneous or oral anticoagulants on the prevention of deep vein thrombosis compared with the use of compression devices on the prevention of deep vein thrombosis? Research provided limited results for current, evidenced based literature on this question. While 10 research studies and reviews were isolated, only 4 served to meet the purpose of this review as many did not address a comparison of compression versus pharmaceuticals. The results of this review are provided with a summary of the best evidence obtained from these studies, a critique of their content, and an assessment regarding their relevance to practice and recommendations for utilization.

Article Analysis and Review

Systemic Review and Meta-Analysis with an Orthopedic Surgical Focus

The intent of “Comparative Effectiveness of Combined Pharmacologic and Mechanical Thromboprophylaxis versus Either Method Alone in Major Orthopedic Surgery: A Systematic Review and Meta-analysis” was to compare the effectiveness (efficacy) and safety of mechanical versus pharmacological interventions in the prevention of venous thromboembolism (VTE) and adverse health outcomes following major Orthopedic surgery. VTE, for the purposes of this study refers to deep venous thrombosis and pulmonary emboli, both fatal and non-fatal. Further assessment included bleeding risk, post-thrombotic syndrome, and health related quality of life. Of the 3185 citations found, 6 randomized control trials (RTC) met inclusion criteria. “Major” Orthopedic surgery was recognized as total hip replacement (THA), total knee replacement (TKA) and hip fracture surgery (HFS). Data was collected from “Medline, Cochrane Central Register of Controlled Trials, and Scopus databases from January 1980 to March of 2011, with an update in July 2011,” (Sobieraj et al., 2013).

Statistical characteristics were further delineated according to specific surgical procedure (i.e. THA, TKA, HFS) and type of combination or single prophylactic therapy used (pharmacological vs. mechanical). Six RCT’s at first appeared an adequate amount to support the initial focus of the study (efficacy of mechanical vs. pharmacological prophylaxis), however, the intervention comparison subtypes were then categorized further into 19 groups of which 10 had 1 trials pooled, 5 had 2 trials pooled, 2 had 3 trials pooled and 1 had 4 trials pooled, failing to provide sufficient data for comparison. Furthermore, the tables summarizing this information provided a much clearer interpretation of the collected data than did the narrative.

To meet inclusion requirements for this study, data included were only those confirmed by diagnostic imaging; Doppler ultrasound or venography for DVT; spiral CT, angiography or

ventilation-perfusion (VQ) scan for pulmonary embolism (PE) in conjunction with clinical symptomology/suspicion. Additionally, pharmacological intervention could be in the form of aspirin, Lovenox, Heparin, Warfarin, or a combination thereof. Mechanical interventions included venous foot pumps, graduated compression stockings and intermittent pneumatic compression. This criteria further excluded 2 of the 6 RCT's for lack of sufficient strength of evidence for comparison.

“Study quality was assessed using the recommendations in the Methods Guide for Effectiveness and Comparative Effectiveness Reviews,” (Sobieraj et al., 2013). Additionally, a standardized data extraction tool was developed and two independent reviewers assessed quality using an 11 point questionnaire that identified items such as, populations, randomization, allocation concealment and blinding of participants. Four of the six studies were rated as good and provided blinded results. Three of these four studies were specific to THA and one was specific to TKA. Two of the six studies were rated as fair due in part to non-blinding and data collection from HFS which was particularly limited. Interestingly, the conclusion gives the impression that (stating a moderate strength of evidence) “risk of DVT was decreased with the use of combination prophylaxis versus pharmacological prophylaxis alone in patients undergoing total hip replacements or total knee replacements,” (Sobieraj et al., 2013), however this reference is only pertinent to a very limited segment of this study, and thus provides little in support to the study objective. Also of note is that the credentialing and/or qualifications of participants of this meta-analysis compilation were not provided and are not known. Additionally, five of the thirteen cited references presented date back to 1991; with only three of the thirteen being within the last three years. Not to discount more distant studies, as they may well remain the gold

standard in practice, yet the particular studies located did not provide sufficient recent data to include in this review.

Systemic Review and Meta-Analysis with a Trauma Focus

In the Eppsteiner et al. (2010) article titled “Mechanical Compression Versus Subcutaneous Heparin Therapy in Postoperative and Post trauma Patients: A Systematic Review and Meta-Analysis,” the authors used a computerized search as well as manual searches of MEDLINE and EMBASE to find 16 studies of post-surgical patients. These studies used a randomized comparison of the use of prophylaxis with mechanical compression versus subcutaneous heparin in patients who had developed a DVT, PE, or bleeding. They also conducted stratified and meta-regression analyses to determine the impact that individual study characteristics had on the overall results (Eppsteiner, et al., 2009). The article discusses the effectiveness of these preventative strategies, risk factors involved, and a comparison of the findings.

The authors completed a meta-analysis to evaluate findings using a random effects model (Eppsteiner, et al., 2009). This was done using a relatively large sample size which compared the findings of 3,887 subjects. The findings of this article suggest that in regards to prevention of post-operative blood clots both methods of prevention are similarly effective (Eppsteiner, et al., 2009). The results also showed that the risk of complications related to bleeding was significantly lower in the patients that were treated with preventative mechanical compression versus those who were treated with preventative heparin therapy (Eppsteiner, et al., 2009).

While findings of this comparative study suggest that the effectiveness of these methods is comparable, there are limitations to the study. The authors address the limiting factors that

only orthopedic and general surgery patients were included in the result study and that non-compliance with the use of mechanical compression must also be considered. Another limiting factor is that the studies included data that was collected without blinding in the primary studies. Therefore, there is the possibility that biases may have played a part in certain elements of this analysis (Eppsteiner, et al., 2009).

A Systemic Review Involving Oral Anticoagulants

In the Roderick et al. (2005) article, “Towards Evidence-Based Guidelines for the Prevention of Venous Thromboembolism: Systematic Reviews of Mechanical Methods, Oral Anticoagulation, Dextran, and Regional Anaesthesia as Thromboprophylaxis”, researchers from the Health Care Research Unit at the University of Southampton, UK, and the Clinical Trial Service Unit and Epidemiological Studies Unit at the University of Oxford, UK performed an in-depth study on prevention of deep vein thrombosis. The authors performed a thorough, comprehensive approach in collecting research data, including a systematic search of various electronic databases including EMBASE, MEDLINE, BIOSIS, Derwent, the Antithrombotic Trialists’ Collaboration database, and contacting of medication manufacturers and trialists. The purpose of the study is clearly defined in the title, which lists all methods of DVT prevention reviewed in the study. The authors provide an exceptional abstract, although somewhat lengthy, the reader is given clear, concise information about the research study performed. The objectives of the study are identified as determining the benefits of three types of mechanical compression methods, two pharmacological methods, and a comparison of regional anesthesia versus general anesthesia, in relation to reduction of the incidence of DVT versus risks of bleeding complications with prophylactics use.

The authors performed a meta-analysis of data results, demonstrating the use of mechanical compression as a monotherapy, reduces patient's risk of DVT approximately by two-thirds; when used with a pharmacological intervention like low-molecular-weight heparin (LMWH) injections, the risk of DVT is reduced even greater to approximately one-half. Importantly, Roderick et al. (2005) study identifies the benefits of the use of more than one method of DVT prophylaxis. In conclusion, a combination of prophylactic methods, referred to as adjunct therapy proves to be most beneficial for patients. The authors of this study recommend future studies be conducted to take into consideration patient compliance with DVT prophylaxis and consideration for patient preferences for the mode of prophylaxis given.

A Random Trial with an Arthroscopy Focus

A four year (2002-2006) randomized trial, published in the *Annals of Internal Medicine*, sought to evaluate the impact of a 7 day thromboprophylactic regime following knee arthroscopy. Conducted in Italy, researchers noted the stark lack of prior research on this topic, with no post-surgical prevention measures for deep vein thrombosis currently being standard practice. A team of fifteen medical doctors and Ph.D. educated researchers developed an assessor blind, randomized controlled research study to investigate whether a 7 day post-arthroscopy regimen of low-molecular-weight heparin (LMWH) better inhibits the development of deep vein thrombosis, while not causing more complications, than graduated compression stockings (GCS) in adult patients (Camporese et al., 2008).

The title clearly and appropriately reflects the purpose of the study, however, the article provides little information on the researchers involved, apart from identifying them as MD and/or PHD educated and affiliated with the field of angiology. The abstract portion provided for this report is extremely thorough, providing a clear summary of the background, objective,

design, intervention, measurements, results, limitations and conclusions of the study. The problem that guides this study is best identified in the abstract at the beginning of the introduction, which tells of this by highlighting the lack of prior research on this matter, paired with limited data on the actual occurrence of deep vein thrombosis after an arthroscopy with no prophylactic treatment. This content undoubtedly supports the author's purpose, which is stated in the final sentence of the introduction; testing the efficacy and safety of GCS for 7 days post outpatient arthroscopy, versus LMWH for 7 days or 14 days (the 14 day group was later dropped due to safety concerns) (Camporese et al., 2008).

Study design is described logically, and visual tables are provided which bolster the information related to breakdown of demographics and baseline patient characteristics, as well as excellently showcasing the summary of study design via a study flow diagram. While these aspects are strong, nothing is noted regarding a theoretical framework for the study. Symptomatic and diagnostic data collection identifying DVT and PE were obtained through both patient interviews and imaging using lower extremity ultra-sound and ventilation-perfusion scanning. Statistical data regarding the results is relayed with descriptive statistics presented first, with proportions showing a 95% confidence interval. It was compared using a 2-tailed Fisher exact test.

The author's discuss the limitations of the study extensively, both in abstract and in the study's discussion portion. Due to financial limitations, the study was not double-blind, although physicians evaluating the patients were unaware if they had been treated with LMWH or GCS. Also, diagnosis was used with the use of ultrasonography to evaluate for DVT, leaving room for error in the evaluation of actual occurrences (Camporese et al., 2008). This leads the article to the final conclusion linked to the data found. The author's summarize the final observation that a

7 day prophylactic treatment of LWMH is associated with a 2.3% lower incidence of the development of DVT in comparison to GCS and therefore they are confident in recommending a short LWMH treatment to adult patients following an outpatient arthroscopy (Camporese et al., 2008).

Application of Evidence

After a thorough review of the four research articles discussed, the authors of this paper identified potential barriers to application of the evidence-based practice (EBP), developed a plan for implementation of the EBP, and discussed recommendations based on research findings.

Barriers

With consideration of the research reviewed, the use of both compression devices and oral and subcutaneous anticoagulants have proven to decrease the risk or incidence of patients developing a blood clot postoperatively. Despite their proven benefits, barriers have been identified regarding the implementation of this EBP in the clinical setting. In regards to compression devices, there are medical contraindications preventing patients from using them which include having a diagnosis of peripheral artery disease, fragile skin associated with diabetes, and thrombophlebitis (Roderick et al., 2005, p. 64). In regards to the use of anticoagulants such as low-molecular-weight heparins (LMWH) postoperatively, an identified safety risk is patients suffering from a bleeding event. According to Camporese et al. (2008) research study, 4.4% (29 of 657 patients) who received prophylactic LMWH postoperatively for 7 days suffered from an incidence of bleeding. However, it should be noted that none of the bleeding events were life threatening, and in the worst cases, consisted of hemarthrosis, which required drainage and/or a delay in physical activity.

Patient Preference and Education

When considering the medical use of pneumatic compression devices or anticoagulation injections, the patient's thoughts or perceptions relating to the proposed treatment can be considered a barrier. Although mechanical compression devices can be very practical, one of the primary complaints reported by patients is leg discomfort (Roderick et al., 2005). This makes it more difficult for the patient to agree to wear stockings or compression devices as ordered, often with a goal of 18 hours per day, when they find them uncomfortable.

Issues with patient compliance also exist with anticoagulant medications. Even when the benefits and importance of DVT prophylaxis are communicated to patients they frequently still refuse the medication. The authors of this paper, Registered Nurses (RN), can attest to their own struggles with patients who are uncomfortable with administration of LMWH injections. Some patients report the injection is painful and verbalize frustration with the localized bruising that often occurs. Unfortunately, this occasionally leads patients to rationalize disregarding the benefits of LMWH out of frustration with this secondary effect; even though the bruising is generally short term and not harmful. Additionally, patients may justify not taking the injection based on their activity level, and conclude the injection provides no further benefit if they are out of bed walking.

When caring for postoperative patients it is essential that the nurse properly educate the patient regarding medications they are going to receive and their treatment plan. Providing knowledge and full understanding of these prevention measures allow them to make educated decisions regarding their plan of care. Patients need to know that the care they are being provided is evidence based and research supported for better patient outcomes with the use of prophylaxis to prevent blood clots.

Conclusion with Recommendations of Evidence Utilization

Taking into account the results of the four research founded articles providing evidence based literature regarding the use of mechanical compression verses pharmacological anticoagulation prophylactic medication, recommendations may be made as to how this information can be applied to nursing practice. A review of the literature on this topic, though varied in patient population, study methods and results, can still guide a nurse in the practice of care for post-operative adult patients at risk for deep vein thrombosis. While the decision making and prescribing of medication rests outside the scope of practice of the Registered Nurse, the evidence supports the efficacy of *both* methods of DVT prevention, and at times with similar effectiveness. While the results may vary and be dependent upon the patient and the surgical procedure, research showcases that combination therapy yields beneficial results in patients not at increased risk for bleeding. Therefore, it is crucial that the RN caring for the adult post-operative patient assesses that a form of DVT prevention measure has been ordered and implemented for the patient. Combination therapy is ideal for the post-operative prevention of DVT, and if a patient is not a candidate for oral or subcutaneous anticoagulation, the RN should request an order for mechanical compression from the attending physician. The limited available literature found for this study indicates the potential for further research on this matter, with the hope of producing more conclusive results that will continue to guide the professions of medicine and nursing towards continued improvements in patient care.

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