The Role of Physical Therapists in the Management of Individuals at Risk for or Diagnosed with Venous Thromboembolism – An Evidence-Based Clinical Practice Guideline

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ABSTRACT

The American Physical Therapy Association (APTA), in conjunction with the Cardiovascular & Pulmonary and Acute Care Sections of the APTA, have developed this clinical practice guideline (CPG) to assist physical therapists in their decision making process when managing patients at risk for venous thromboembolism (VTE) or diagnosed with a lower extremity deep vein thrombosis (DVT). No matter the practice setting, physical therapists work with patients who are at risk for and/or have a history of VTE. This document will guide physical therapy practice in the prevention of, screening for and management of patients at risk for or diagnosed with lower extremity DVT (LE DVT).

Through a systematic review of published studies and a structured appraisal process, key action statements were written to guide the physical therapist. The evidence supporting each action was rated and the strength of statement was determined. Table 1 lists the 14 action statements. Clinical practice algorithms (Figures 2-4), based upon the key action statements, were developed that can assist with clinical decision making. Physical therapists, along with other members of the healthcare team, should work to implement these key action statements to decrease the incidence of VTE, improve the diagnosis and acute management of LE DVT, and reduce the long term complications of LE DVT.
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Introduction

Venous thromboembolism (VTE) is the formation of a blood clot in a deep vein that can lead to complications including deep vein thrombus (DVT), a pulmonary embolism (PE), or postthrombotic syndrome (PTS). VTE is a serious condition with an incidence of 10%-30% of people dying within one month of diagnosis and half of those diagnosed with a DVT have long term complications.¹ Even with a standard course of anticoagulant therapy, one third of individuals will experience another VTE within 10 years.¹ For those who survive a VTE, quality of life can be decreased due to the need for long term anticoagulation to prevent another VTE.²

No matter the practice setting, physical therapists work with patients who are at risk for and/or have a history of VTE. Additionally, physical therapists are routinely tasked with mobilizing patients immediately after diagnosis of a VTE. Because of the seriousness of VTE, the frequency that physical therapists encounter patients with a suspected or confirmed VTE, and the need to prevent future VTE, the American Physical Therapy Association (APTA) in conjunction with the Cardiovascular & Pulmonary and Acute Care Sections of the APTA, support the development of this clinical practice guideline (CPG). It is intended to assist all physical therapists in their decision making process when managing patients at risk for VTE or diagnosed with a lower extremity deep vein thrombosis (LE DVT).

In general, CPGs optimize the care of patients by building upon the best evidence available while at the same time examining the benefits and risks of each care option.³ The VTE guideline development group (GDG) followed a systematic process to write this CPG with the overall objective of providing physical therapists with the best evidence in preventing VTE, screening for
LE DVT, mobilization of patients with LE DVT, and management of complications of LE DVT.

Specifically, this CPG will:

- Discuss the role of physical therapists in identifying patients who are high risk of a VTE and actions that can be taken to decrease the risk of a first or recurring VTE.
- Provide physical therapists with specific tools to identify patients who may have a LE DVT and determine the likelihood of a LE DVT.
- Assist physical therapists in determining when mobilization is safe for a patient diagnosed with a LE DVT based on the treatment chosen by the inter-professional team.
- Describe interventions that will decrease diagnosis complications such as Post-Thrombotic Syndrome (PTS) or another VTE.
- Create a reference publication for healthcare providers, patients, families/caretakers, educators, policy makers, and payers on the best current practice of physical therapy management of patients at risk for VTE and diagnosed with a LE DVT.
- Identify areas of research that are needed to improve the evidence base for physical therapy management of patients at risk for or diagnosed with VTE.

This CPG can be applied to adult patients across all practice settings, but does not address nor apply to those who are pregnant or to children. Additionally, this guideline does not discuss the management of PE, upper extremity DVT (UE DVT) or chronic thromboembolism pulmonary hypertension (CTEPH). While primarily written for physical therapists, other healthcare professionals should find this CPG helpful in their management of patients who are at risk for or have a diagnosed VTE.
Background and Need for a CPG on Venous Thromboembolism

Venous thromboembolism is a life-threatening disorder that ranks as the third most common cardiovascular illness after acute coronary syndrome and stroke. VTE consists of DVT and PE, two inter-related primary conditions caused by venous blood clots, along with several secondary conditions including PTS and CTEPH. From a primary and secondary prevention perspective, the seriousness of VTE development related to mortality, morbidity, and diminished life-quality is a world-wide concern. The incidence of VTE differs greatly among countries. For example, the United States ranges from 70 to 120 cases/100,000 habitants per year, and in Europe there are between 140 and 240 cases/100,000 habitants per year, with sudden death being a frequent outcome.

Deep vein thrombosis is a serious yet potentially preventable medical condition that occurs when a blood clot forms in a deep vein, most commonly in the calf, thigh, or pelvis. A life threatening, acute complication of LE DVT is PE. This occurs when the clot dislodges, travels through the venous system and causes a blockage in the pulmonary circulatory system. A proximal LE DVT, defined as occurring in the popliteal vein or veins more cephalad, is associated with an estimated 50% risk of PE if not treated as compared to approximately 20% to 25% of LE DVTs below the knee (Heit 2001). Approximately one in five individuals with acute PE die almost immediately, while 40% will die within three months. In those who survive PE, significant cardiopulmonary morbidity can occur, most notably CTEPH.
CTEPH can be the result of a single PE, multiple PEs, or recurrent PEs. Acutely, PE causes an obstruction of flow. This narrowing of the lumen may lead to reduced oxygenation and pulmonary hypertension. Chronically, the infarction of lung tissue following PE may result in a reduction of vascularization and concomitant pulmonary hypertension. Over time, the workload imposed on the right heart increases and contributes to right heart dysfunction and then failure. A new syndrome, post-PE syndrome, has more recently been proposed to capture those patients with persistent abnormal cardiac and pulmonary function that do not meet the criteria for CTEPH. These conditions are associated with diminished function and lowered quality of life.

Beyond the threat of PE and its sequelae, LE DVT may lead to the long-term complications. PTS is the most frequent complication and develops in up to 50% of these patients even when an appropriate anticoagulant is used. A clot remaining in the vein of the LE can obstruct blood flow leading to venous hypertension. Additionally, damage to the vein itself occurs and leads to inflammation and necrosis of the vein which eventually is removed by phagocytic cells, leading to venous hypertension. This impaired blood flow can lead to classic symptoms of PTS which often includes chronic aching pain, intractable edema, limb heaviness, and leg ulcers. This chronic pathology can cause serious long-term ill health, impaired functional mobility, poor quality of life, and increased costs for the patient and the healthcare system.

Across various practice settings, physical therapists encounter patients who are at risk for VTE, may have an undiagnosed LE DVT, or have recently been diagnosed with a LE DVT. The physical therapist's responsibility to every patient is five-fold: 1. prevention of VTE; 2. screening for LE DVT; 3. contributing to the healthcare team in making prudent decisions regarding safe mobility for these patients; 4. patient education and shared decision-making; and 5. prevention
of long term consequences of LE DVT. Such decisions should always be made in collaboration with the referring physician and other members of the healthcare team, i.e., it is assumed that such decisions will not be made in isolation, and that the physical therapist will communicate with the medical team.

Due to the long standing controversy regarding mobilization versus bed rest following VTE diagnosis and with the development of new anticoagulation medications, the physical therapy community needs evidence based guidelines to assist in clinical decision making. This clinical practice guideline is intended to be used as a reference document to guide physical therapy practice in the prevention of, screening for, and management of patients at risk for or diagnosed with LE DVT. This CPG is based upon a systematic review of published studies on the risks of early ambulation in patients with diagnosed DVT and on other established clinical guidelines on prevention, risk factors, and screening for VTE and PTS. In addition to providing practice recommendations, this guideline also addresses gaps in the evidence and areas that require further investigation.

**Methods**

The guideline development group (GDG), which was comprised of physical therapists with special interest in acute care and cardiovascular and pulmonary practice, was appointed by the Cardiovascular and Pulmonary and the Acute Care Sections to develop a guideline to address the physical therapist’s role in the management of VTE. In specific, the role of mobility was identified as a major issue facing both sections. Models used by the APTA Pediatric Section for their CPG on Physical Therapy Management of Congenital Muscular Torticollis were
primarily used to develop this CPG as well as other APTA supported CPGs and international processes. In July 2012, the GDG initiated the process under the guidance of the APTA and developed a list of topic areas to be covered by the CPG. In addition, topic areas were solicited from clinicians with content experience in the area of VTE who volunteered to assist. A resultant list of topic areas was developed to determine the scope of the CPG and provided the GPG with limits to the literature search.

**Literature Review**

A search strategy was developed and performed by a librarian to identify literature published between May 1, 2003 and May, 2014 addressing mobilization and anticoagulation therapy to prevent and treat VTE. Searches were performed in the following databases: PubMed, CINAHL, Web of Science, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects (DARE), and the Physiotherapy Evidence Database (PEDro). Controlled vocabularies, such as MeSH and CINAHL Headings, were used whenever possible in addition to keywords. Results were limited to articles written in English (Refer to Figure 1). Using this search strategy, 350 out of 8,652 abstract/citations of relevance were obtained from Web of Science, CINAHL, PubMed, and Cochrane.

Clinical practice guidelines published between 2003 and 2014 were searched including the same key words and MESH terms using the National Guideline Clearinghouse (NGC www.guideline.gov/) database as well as TRIP (http://www.tripdatabase.com/). The NGC database identified 169 guidelines of which 40 were deemed as appropriate to be reviewed.
Three additional guidelines were identified through Tripdatabase and the appropriate target populations were included.

**Method: Literature Review Procedures**

The results of the literature and guideline searches were distributed to the members of the GDG. One member of the group reviewed a list of citations and another member performed a second review of the same list of citations. Articles were included based on whether or not key topics were addressed and the appropriate target populations were included. Case reports and pediatric articles were excluded. The GDG, along with clinicians and academicians who volunteered from both Cardiovascular and Pulmonary and the Acute Care Sections, were invited to review the identified literature.

Reliability of appraisers was established prior to articles being reviewed. Selected articles were reviewed by three individuals who used one of three critical appraisal tools adapted from an evidence based practice textbook to evaluate each according to its type i.e. critical appraisal for studies of prognosis, diagnosis or intervention. The Assessment of Multiple Systematic Review (AMSTAR) tool was used for systematic reviews. Selected diagnosis, prognosis and intervention articles as well as systematic reviews were critically appraised by the GDG to establish test standards. Inter-rater reliability among the four core group members was first established on test articles. Volunteers completed critical appraisals of the test articles to establish inter-rater reliability. Volunteers qualified to be appraisers with agreement of 90% or more. Appraisers were randomly paired to read each of the remaining diagnostic, prognostic or
intervention articles. Discrepancies in scoring between the readers were resolved by a member of the GDG.

Clinical practice guidelines were reviewed that fit the scope of this CPG as well as the patient population. Guidelines were included based on whether or not key topics were addressed and the target populations were included. The results of the clinical practice guidelines search were reviewed by one member of the GDG. Four additional clinical expert volunteers underwent training in the Appraisal of Guidelines for Research and Evaluation II (AGREE II) tool to evaluate CPGs with subsequent reliability testing being performed on all reviewers.

Levels of Evidence and Grades of Recommendations

The GDG followed a previously published process on developing physical therapy clinical practice guidelines. Table 2 lists criteria used to determine the level of evidence associated with each practice statement, with Level I as the highest and Level V as the lowest levels of evidence. Table 3 presents the criteria for the grades assigned to each action statement. The grade reflects the overall and highest levels of evidence available to support the action statement.

Statements that received an A or B grade should be considered as well supported. The clinical practice guideline lists each key action statement followed by rating of level of evidence and grade of the recommendation. Under each statement is a summary providing the supporting evidence and clinical interpretation. The statements are organized in Table 1 according to the action statement number, the statement, and then the key phrase or action statement.

Document Structure
The action statements organized in Table 1 are introduced with their assigned recommendation grade, followed by a standardized content outline generated by the BRIDGE-WIZ software. Each statement has a content title, a recommendation in the form of an observable action statement, indicators of the evidence quality, and the strength of the recommendation. The action statement profile describes the benefits, harms, and costs associated with the recommendation, a delineation of the assumptions or judgments made by the GDG in formatting the recommendation, reasons for any intentional vagueness in the recommendation, and a summary and clinical interpretation of the evidence supporting the recommendation. The Delphi process was used to determine level of evidence and recommended strength for each key action statement. Each member of the GPG reviewed the supporting evidence for each key action statement and voted on level of evidence and strength of recommendation independent of the other group members using a google survey upon which all votes were tallied and then reported.

The Scope of the Guideline

This CPG uses literature available from 2003 through 2014 to address the following aspects of physical therapists’ management of patients with potential or diagnosed VTE. The CPG addresses these aspects of VTE management via 14 action statements. Clinical practice algorithms (Figures 2-4), based upon the key action statements, were developed that can assist with clinical decision making.

KEY ACTION STATEMENTS WITH EVIDENCE:

Action Statement 1: ADVOCATE FOR A CULTURE OF MOBILITY AND PHYSICAL ACTIVITY.
Physical therapists and other healthcare practitioners should advocate for a culture of mobility and physical activity. (Evidence Quality: I Recommendation Strength: Strong)

Action Statement Profile

Aggregate Evidence Quality: Level I
Benefits: Decreased likelihood of LE DVT and/or PE and/or PTS
Risk, Harm, Cost: Injuries from falls
Benefit-Harm Assessment: Preponderance of benefit
Value Judgments: Physical therapists should advocate for mobility in all situations due to the evidence on the benefits of activity and risks associated with inactivity and bed rest except when there could be a risk of harm (e.g. emboli depositing in the pulmonary system).

Intentional Vagueness: None
Role of Patient Preferences: Since the evidence for risks associated with inactivity is strong and with little associated risk of mobility in the absence of thromboembolism, patients should be educated regarding the benefits of mobility and encouraged to maintain mobility as much as possible to decrease the risk of adverse outcomes.

Exclusions: None

Summary of Evidence

Reduced mobility is a known risk factor for VTE, yet the quantity and duration of the reduced mobility that defines degree of risk for VTE is not known.\textsuperscript{18-20} Significant variability exists in the literature regarding reduced mobility and the resulting risk for VTE.\textsuperscript{21} Ambulatory patients were found to be at increased risk for developing a VTE with standing time of 6 or more hours (1.9 odds ratio or OR) and/or resting in bed or a chair (5.6 OR).\textsuperscript{22} Likewise, a significant correlation exists between loss of mobility status for 3 or more days and the presence of LE DVT on Doppler ultrasound.\textsuperscript{23}

When additional risk factors for VTE are present in an individual who has any reduction in mobility, the risk for VTE is significantly increased. Increased age serves as an example. One study of hospitalized patients older than 65 found reduced mobility to be an independent risk factor for VTE. The risk increased based upon the degree of immobility and relative risk scores
were derived according to the degree of immobility (Table 4).\textsuperscript{18,24} The odds ratio or risk was found to be higher in older patients with more severe limitation of mobility (bed rest versus wheelchair) and when the loss of mobility was more recent (< 15 days versus > 30 days).

Recent national guidelines have associated reduced mobility with increased risk of VTE.\textsuperscript{19,25} The National Institute for Health and Clinical Excellence (NICE) guidelines present strong recommendations for the need to regard surgical patients and patients with trauma at an increased risk of VTE. When patients undergo surgery with an anesthesia time of greater than 90 minutes or if the surgical procedure involves the pelvis or lower limb and anesthesia time is greater than 60 minutes, the risk is much greater. Individuals who are admitted acutely for surgical reasons or admitted with inflammatory or intra-abdominal conditions also are at high risk for developing a VTE. These same guidelines emphasized the need to identify all individuals who are expected to have any significant reductions in mobility to be at risk for VTE, and to mobilize them as soon as possible.\textsuperscript{19} The American College of Chest Physicians (ACCP) guidelines emphasize prevention of VTE in nonsurgical patients by incorporating non-pharmacological prophylaxis measures including frequent ambulation, calf muscle exercise, and sitting in the aisle and mobilizing the lower extremities when traveling (Grade 2C recommendations).\textsuperscript{25,26}

Previously, when individuals were diagnosed with a LE DVT, they were placed on bed rest due to the concern that ambulation would cause clot dislodgment and lead to a potentially fatal PE. However, a meta-analysis compiled data from 5 randomized control trials (RCT) on more than 3,000 patients and concluded that early ambulation following diagnosis of a LE DVT was not associated with a higher incidence of a new PE or progression of LE DVT as compared to bed rest.\textsuperscript{27} Rather, there was a lower incidence of new PE and overall mortality in those patients who
engaged in early ambulation. Similar findings, as well as more rapid resolution of pain, were reported in a systematic review which included seven RCTs and two prospective observational studies. The importance of mobility is further discussed in key action statement 8.

In summary, mobility should be encouraged in patients while in the hospital and when discharged to prevent the complications associated with immobility. In addition, mobility is recommended for those diagnosed with VTE once therapeutic anticoagulant levels have been reached. (See Action Statement 8)

**Action Statement 2: SCREEN FOR RISK OF VTE.**

Physical therapists should screen for risk of VTE during the initial patient interview and physical examination (Evidence Quality: I; Recommendation Strength: Strong)

**Action Statement Profile**

- **Aggregate Evidence Quality:** Level I
- **Benefits:** Prevention and/or early detection of LE DVT
- **Risk, Harm and Cost:** Adverse effects of prophylaxis interventions
- **Benefit-Harm Assessment:** Preponderance of benefit over harm
- **Value Judgments:** None
- **Intentional Vagueness:** Physical therapists should work within their healthcare system to determine specific algorithms or risk assessment models to use.
- **Role of Patient Preference:** None
- **Exclusions:** None

**Summary of Evidence**

The *Guide to Physical Therapist Practice* states that the physical therapy examination is a comprehensive screening and specific testing process leading to diagnostic classification or, as appropriate, to a referral to another practitioner. Understanding the factors that place
individuals at risk for a VTE is important for all physical therapists. During the patient interview, physical therapists should ask questions and review the medical history to determine if the patient is at risk for LE DVT (Table 1). The relationship between particular risk factors and presence of LE DVT has been found through retrospective and prospective studies and identified as having support from Level I evidence in other clinical practice guidelines.\(^\text{18, 30-33}\)

The need for all healthcare providers to screen for risk of LE DVT through system wide approaches has been highlighted by the US Agency for Healthcare Research and Quality\(^\text{34}\), Finnish Medical Society\(^\text{30}\) and Scottish Intercollegiate Guidelines Network\(^\text{35}\) and is strongly recommended by each of these groups. Furthermore, the importance of screening was strongly supported in a 2008 multi-national cross sectional study of patients from over 350 hospitals across 32 countries. Findings revealed that 39.5% of patients at risk for VTE were not receiving appropriate prophylaxis.\(^\text{36}\) Hospital wide strategies were recommended to assess patient’s VTE risk and to monitor whether those at risk received appropriate prophylaxis.

To facilitate and standardize the process of screening for risk within healthcare systems and across professions, assessment models (RAM) should be considered.\(^\text{35, 37}\) Risk assessment models use a checklist to determine if risk factors for LE DVT are present and each risk factor is assigned a point value. If a set point level is reached, the patient is considered at an increased risk and more aggressive prophylactic interventions can be used. There are numerous examples of RAMs in the literature including the Padua Score for assessing VTE Risk in Hospitalized Patients\(^\text{38}\), the IMPROVE VTE RAM\(^\text{39}\), the Autar DVT Risk Assessment Scale\(^\text{40}\) and the Geneva Risk Score\(^\text{41}\). None have been shown to be superior to others through direct comparisons and for this reason, the GDG cannot recommend a single RAM. It is more important that physical therapists
work within their healthcare system to understand and even help develop an overall VTE protocol that uses an agreed upon tool for VTE risk assessment.

In summary, given the risks and harms associated with a VTE and relationship of VTE incidence to the presence of risk factors, physical therapists should screen for VTE risk. These results should be communicated with the rest of the healthcare team.

**Action Statement 3: PROVIDE PREVENTIVE MEASURES FOR LE DVT.**

Physical therapists should provide preventive measures for LE DVT for patients who are identified as being at risk for LE DVT. These measures should include education regarding signs/symptoms of LE DVT, activity, hydration, mechanical compression, and referral for medication assessment. (Evidence Quality: I; Recommendation Strength: Strong)

**Action Statement Profile**

- **Aggregate Evidence Quality:** Level I
- **Benefits:** Prevention of LE DVT
- **Risk, Harm, Cost:** None to minimal
- **Benefit-Harm Assessment:** Preponderance of benefit over harm
- **Value Judgments:** None
- **Intentional Vagueness:** None
- **Role of Patient Preferences:** Patients may or may not choose to comply with preventive measures. There is a role for having shared decision-making with regard to their priorities.
- **Exclusions:** None

**Summary of Evidence**

For individuals who are at risk for LE DVT, preventive measures should be initiated immediately, including education regarding leg exercises, ambulation, proper hydration, mechanical compression, and assessment regarding the need for medication referral.

Education is a key factor in risk reduction of VTE and should be provided for patients who are at elevated risk for LE DVT as well as for their families. Documentation of the patient’s
understanding of these concepts should also be included. Table 5 outlines topics that should be included in this education program for patients and their families.

Immobilization is one of the primary risk factors for VTE and is a problem for patients in acute care settings, home, and long term care facilities. Table 6 provides criteria that expands the definition for immobilization as it relates to residents in long term care facilities. Patients who are limited to a chair or bed greater than half the day during waking hours are considered at elevated risk for VTE. The acuteness and severity of the immobility determines the elevated risk-level of developing VTE.

As immobility also occurs with long distance travel, travelers on planes for greater than 2-3 hours are also at increased risk for LE DVT. The ACCP recommends that such travelers ambulate frequently, perform calf muscle exercises, sit in an aisle seat, and use below the knee compression stockings with at least 15-30 mm Hg compression (2C recommendation).

**Action Statement 4: RECOMMEND MECHANICAL COMPRESSION AS A PREVENTIVE MEASURE FOR DVT.**

Physical therapists should recommend mechanical compression (e.g. intermittent pneumatic compression &/or graded compression stockings) when individuals are at moderate to high risk of LE DVT or when anticoagulation is contraindicated. (Evidence Quality: I; Recommendation Strength: Strong)

**Action Statement Profile**

**Aggregate Evidence Quality:** Level I

**Benefits:** Prevents LE DVT without increasing the risk of bleeding.

**Risk, Harm, Cost:** Improper fit can lead to skin irritation, ulceration, and/or interruption of blood flow.

**Benefit-Harm Assessment:** Preponderance of benefit over harm

**Value Judgments:** None

**Intentional Vagueness:** Specific type(s) of mechanical compression were not recommended. Physical therapists should work within their healthcare system to develop institution-specific protocols.
Role of Patient Preference: Ease of use, comfort-level, and/or ability to operate mechanical compression equipment properly should be evaluated with each patient.

Exclusions: Patients who have severe peripheral neuropathy, decompensated heart failure, arterial insufficiency, dermatologic diseases, or lesions may have contraindications to selective mechanical compression modes.

Summary of Evidence
The influence of mechanical compression on LE DVT and/or PE prophylaxis was examined in 7 systematic reviews. The populations included patients who were in post-operative recovery from a variety of surgical procedures with or without pharmacological prophylaxis. Also included were airline travelers of varying VTE risk levels. These studies supported that graded compression stockings (GCS) used alone significantly decreased the incidence of LE DVT and/or PE and that this mechanical compression method provided additional benefit when combined with other prophylactic methods. Although GCS was the method of mechanical compression in all seven of these publications, the descriptive features of the GCS were inconsistent.

Screening to identify VTE risk is essential and will identify which, if any, mechanical compression method is appropriate to implement. In the CPG of the Japanese Circulation Society (JCS) for PE and LE DVT prevention, elastic stockings or intermittent pneumatic compression (IPC), IPC or anticoagulation, and anticoagulation plus IPC or elastic stockings are recommended for post-operative patients with elevated risk. The Institute for Clinical Systems Improvement (ICSI) guidelines for VTE prophylaxis recommends that if contraindications exist for both low molecular weight heparin (LMWH) and low dose unfractionated heparin (UH or UFH) and there is high-risk for VTE but not high-risk for bleeding, Fondaparinux or low dose aspirin or IPC be used. One example would be someone with a Heparin induced thrombocytopenia (HIT) history. Graduated compression stockings or IPC are recommended for acutely or critically ill medical
patients who are bleeding or are at high risk for major bleeding, until bleeding risk decreases at which time pharmacological thrombo-prophylactic methods can be substituted.37,52

A systematic review of 6 RCTs looked at patients at high-risk for VTE who underwent various surgical procedures to assess the effectiveness of IPC combined with pharmacological prophylaxis versus single modality usage.53 Combining IPC with an anti-coagulant (e.g. LMWH) was more effective in VTE prevention than either IPC or anticoagulant use alone which is consistent with the CPG recommendation offered by the JCS.

In summary, there is substantial supportive evidence for the use of mechanical compression methods for medical and surgical patients35,54 55-58 prolonged air-flight travelers6,45, 47 and patients in long-term care facilities.43 For those persons at increased risk for VTE, the use of GCS or IPC, with or without anticoagulation therapy, is considered to be beneficial. The evidence is inconsistent, however, in describing the optimal protocols for use of GCS, elastic stockings, or IPC. Potential for rare circulatory compromise with the use of GCS (i.e. knee- or thigh-length) warrants proper fitting and careful monitoring of skin condition by the patient and physical therapist.

**Action Statement 5: IDENTIFY THE LIKELIHOOD OF LE DVT WHEN SIGNS AND SYMPTOMS ARE PRESENT**

Physical therapists should establish the likelihood of LE DVT when the patient presents with pain, tenderness, swelling, warmth, and/or discoloration in the lower extremity. (Evidence Quality: II; Recommendation Strength: Moderate)
Aggregate Evidence Quality: Level II

Benefit: Early intervention and prevention of adverse effects of LE DVT.

Risk, Harm, Cost: None

Benefit-Harm Assessment: Preponderance of benefit over harm

Value Judgments: While the Wells’ Criteria for LE DVT is recommended by this GDG, there are other tools that may be preferred by other inter-professional teams.

Intentional Vagueness: None

Role of Patient Preference: None

Exclusions: None

Summary of Evidence

The major signs and symptoms of LE DVT include pain, tenderness, swelling, warmth, or redness/discoloration (Table 7). Presence of these signs and symptoms should raise the suspicion of a LE DVT, but they cannot be used alone in the diagnostic process.30,59 The likelihood of LE DVT should be established through use of a standardized tool. This recommendation is supported by numerous CPGs25, 35, 59, 60 and a meta-analysis.61 A standardized tool uses the presence of clinical features of a LE DVT to determine the likelihood that a LE DVT is present and guides the selection of the most appropriate test to diagnose a LE DVT. Physical therapists should use a standardized tool as part of their examination process when signs and symptoms of LE DVT are present. The results of the assessment should then be communicated with the medical team.

The Wells’ Criteria for LE DVT is the most commonly used tool to determine likelihood of LE DVT (Table 8).20,62 Originally, the Wells’ Criteria for LE DVT used a three tier risk stratification of low, moderate, and high. A score of 3 or greater was high risk, 1-2 was moderate and 0 or below was low risk. In a study of 593 patients, 16% had a LE DVT. When the rate of LE DVT was examined in each stratification level the rates were 3% (1.7-5.9% 95% CI), 16.6% (12%-23% 95%
CI) and 74.6% (63-84% 95% CI) for low, moderate and high risk, respectively. Other studies have found a clear distinction in the rate of LE DVT between the three risk stratification levels. A 2014 systematic review showed that as the score on the Well’s increased, so did the likelihood of a LE DVT. This relationship has held up across multiple subgroups of patients including outpatient, inpatient, those with malignancy, gender, and previous history of a LE DVT.

In 2003, the Wells’ Criteria for LE DVT was modified to a two-stage stratification of 1. LE DVT likely; or, 2. LE DVT unlikely, and a history of previous LE DVT was added to the tool. Reducing the model to two levels was easier to use and did not compromise patient safety when used in conjunction with a D-dimer test. Individuals with 2 or more points were categorized as likely and less than 2 were unlikely. In a study of 1082 outpatients, 27.9% (23.9-31.8% 95% CI) of those classified as likely had a proximal LE DVT or a PE. Of those patients classified as unlikely, 5.5% (3.8-7.6%) had a proximal LE DVT or a PE.

Beyond the Wells’ Criteria for LE DVT, other risk stratification tools have been developed, but there are limited comparison studies between the tools. One example is the Oudega Rule, developed for primary care providers. When compared to the Wells’ Criteria for LE DVT, it has similar effectiveness.

The Wells’ Criteria for LE DVT has a long and well supported history of successfully stratifying risk or likelihood of LE DVT across patient populations and practice settings and is therefore the GDG recommends this tool for risk stratification. Physical therapists should advocate for its use with their interdisciplinary team and determine the best way to communicate the results and risks.
Action Statement 6: COMMUNICATE THE LIKELIHOOD OF LE DVT AND RECOMMEND FURTHER MEDICAL TESTING.

Physical therapists should recommend further medical testing after the completion of the Wells’ Criteria for LE DVT prior to mobilization (Evidence quality: I; Recommendation strength: Strong)

Action Statement Profile
Aggregate Evidence Quality: Level I
Benefit: Risk stratification can ensure proper diagnostic testing is completed
Risk, Harm, Cost: None
Benefit-Harm Assessment: Preponderance of benefit over harm
Value Judgments: None
Intentional Vagueness: None
Role of Patient Preference: None
Exclusions: None

Summary of Evidence
Once the Wells’ Criteria for LE DVT is complete, medical testing can be ordered by the medical team to diagnose or rule out a LE DVT. The selection of which medical test is beyond the scope of physical therapy practice, but there is benefit in understanding why tests are selected and how results guide the diagnostic process. If a patient is classified as unlikely to have a LE DVT, then the overwhelming recommendation is for the medical team to order a D-dimer test over other more costly and invasive tools. 25, 30, 42, 68, 69 Within the referenced clinical practice guidelines, the evidence is rated as level I with grade of A to B for the recommendation. D-dimer
is a measure of the breakdown or degradation of cross-linked fibrin which increases in the presence of a thrombosis. In patients with a LE DVT- unlikely classification and a negative D-dimer, less than 1% have a LE DVT and studies report sensitivity in upper 90s to 100%.\textsuperscript{70-72} These patients need no further testing and can be considered safe to mobilize.\textsuperscript{25, 30, 35, 42, 68}

While the D-dimer test has high sensitivity, it has poor specificity. A positive D-dimer test does not indicate a definite LE DVT. A range of conditions, such as older age, infections, burns, and heart failure can lead to an elevated D-dimer test and hospitalized individuals have a high rate of false positives when the D-dimer is used for a suspected LE DVT.\textsuperscript{73} When a LE DVT- unlikely patient has a positive or high D-dimer level, further testing is necessary. Most guidelines recommend a Doppler Ultrasound to confirm a LE DVT.\textsuperscript{25, 42, 60, 69} There is some debate on the type of ultrasound that is ordered, but this is beyond the focus of these guidelines. If the ultrasound confirms a LE DVT, medical treatment should be initiated and mobilization postponed. If the ultrasound is negative, the patient is safe to mobilize.

A patient rated as LE DVT-likely should immediately undergo a Duplex ultrasound.\textsuperscript{25, 30, 60, 69} Individuals in the DVT-likely category will test positive on the D-dimer test, so D-dimer has little value. If the ultrasound is negative, the physical therapist should consider the patient safe to mobilize. If the ultrasound is positive the physical therapist should defer mobility until medical treatment has achieved therapeutic levels.

In summary the results of the Wells’ Criteria for LE DVT should guide the selection of medical testing. Following the results of the medical team, the physical therapist can then make a decision about when it is safe to mobilize the patient.
Statement 7: VERIFY THE PATIENT IS TAKING AN ANTICOAGULANT.

When a patient has a recently diagnosed LE DVT, the physical therapist should verify if the patient is taking an anticoagulant medication, what type of anticoagulant medication, and when the anticoagulant medication was initiated. (Evidence Quality: V; Recommendation Strength: Theoretical/foundational)

Action Statement Profile

Aggregate Evidence Quality: Level V

Benefit: Decreased risk of a PE in patients who are adequately anti-coagulated

Risk, Harm, Cost: Risk of bleeding with anticoagulation, risk of adverse effects with restrictions in inactivity, and cost of new anticoagulants may be prohibitive in those with inadequate pharmacy insurance coverage.

Benefit-Harm Assessment: Preponderance of benefit over harm

Value Judgments: Intentional Vagueness: This clinical practice guideline has provided therapeutic ranges for anticoagulants that have been provided by the manufacturers due to the limited evidence beyond this. While the recommendation strength is weak based upon scientific evidence, the GDG considers it prudent to follow the manufacturer’s recommendations.

Role of Patient Preference: Patients should be informed of the importance for continuing anticoagulation upon discharge from the hospital as different anticoagulants require monitoring, cost, and modification of diet and bleeding risk.

Exclusions: None

Summary of Evidence

Anticoagulants are the primary defense used to prevent and treat a LE DVT and consequent PE and/or PTS. Contrary to popular belief, anticoagulants do not actively dissolve a blood clot, but instead prevent new clots from forming. Although anticoagulants are often referred to as blood thinners, they do not actually thin the blood. This class of drugs works by altering certain chemicals in the blood necessary for clotting to occur. Consequently, blood clots are less likely to form in the veins or arteries, and yet continue to form where needed. While
anticoagulants do not break down clots that have already formed, they do allow the body’s natural clot lysis mechanisms to work normally to break down clots that have formed.

Once a LE DVT is diagnosed, anticoagulant therapy is initiated, most commonly with a low molecular weight Heparin (LMWH). Anticoagulant therapy will help to stop an existing clot from getting larger as well as prevent any new clots from forming. In addition, LMWHs have been shown to stabilize an existing clot and resolve symptoms through the drug’s anti-inflammatory properties, making a clot less likely to migrate as an embolus.

A patient diagnosed with a LE DVT is at risk of developing a PE; therefore mobility is contraindicated until intervention is initiated to reduce the chance of emboli traveling to the lungs. According to the American College of Chest Physician (ACCP) guidelines on antithrombotic therapy, anticoagulation is the main intervention and should be initiated as soon as possible (Level I, strong evidence). If the patient is at a high risk for bleeding, the primary contraindication to anticoagulation, then medications may not be prescribed. Therefore, prior to initiating mobility out of bed, a physical therapist should review all medications the patient has been prescribed and verify that the patient is taking an anticoagulant. The physical therapist should next consult with the medical team regarding appropriateness of mobility. Although physical therapists do not play a role in recommending the anticoagulant of choice, they should identify which anticoagulant the patient has been prescribed as well as date and time of the first dose. This will assist the physical therapist in determining when the patient has reached a therapeutic dose, and consequently, when mobility may be initiated safely.
The current options for anticoagulation include unfractionated heparin (UFH), low molecular weight heparin (LMWH), Coumadin (warfarin), Fondaparinux, and oral thrombin or Xa inhibitors (See Table 9). Most patients with a confirmed diagnosis of LE DVT or PE are prescribed a form of LMWH or Fondaparinux (both given with subcutaneous injections). LMWH is principally used to treat any LE DVT below the knee, at thigh level, and more proximal thrombi. It is the anticoagulant of choice for pregnancy and for active cancer as well as the primary choice of physicians for treatment of VTE in the outpatient or home setting due to ease of use and low incidence of side effects. LMWH is used in most cases except when a patient has renal dysfunction or a creatinine clearance less than 30 ml/min. Concomitant Coumadin use may be started and provided for three days with subsequent International Normalized Ratio (INR) values being determined. Most individuals will continue with their initial anticoagulant (LMWH or Fondaparinux) for three to six months for the first episode of diagnosed thrombosis. If Coumadin is given concomitantly, they will likely be removed from the initial anticoagulant and continued on Coumadin for 3-6 months.

Anti-Xa levels can be used to monitor LMWH. However, evidence does not support the use of anti-Xa assay levels for predicting thrombosis and bleeding risk. Pharmacokinetic studies on LMWH report maximum anti-factor Xa and anti-thrombin IIa activities occur three to five hours after subcutaneous injection of LMWH. The optimal therapeutic anti-Xa levels for treatment are .5-1.0 units/ml. Due to the fact LMWH is excreted primarily by kidneys, increased bleeding complications have been reported when LMWH is used in patients with renal insufficiency and other populations. Therefore, precautions for bruising and bleeding with physical therapy interventions should be taken when LMWH is used in patients with kidney injury.
or dysfunction, patients in extreme weight ranges, patients who are pregnant, and in neonates and infants.60

Unfractionated heparin is indicated for individuals with high bleeding risk (Refer to Table 9) and/or renal disease. Patients with established or severe renal impairment are defined as those with an estimated glomerular filtration rate (eGFR) of less than 30 ml/min/1.73m². UFH is often prescribed and dosed to achieve therapeutic levels quickly. Lower speed of infusion is usually given in acute coronary syndromes whereas higher speeds of infusion are given with VTE. Several institutions have transitioned from monitoring heparin with anti-factor Xa levels instead of aPTT due to influencing factors that can alter aPTT levels.82 One study has shown anti-Xa detects therapeutic levels faster than aPTT (UFH patients achieved therapeutic anticoagulation in approximately 24 hours compared to patients monitored with aPTT which averaged 48 hours).82 Patients with a documented PE, including those hemodynamically unstable, are often prescribed UFH and similar aPTT monitoring should be reviewed by the physical therapist seeing the patient.69

Coumadin is usually not the first medication choice for anticoagulation due to the length of time to achieve peak therapeutic levels. Coumadin is typically introduced day one during administration of another anticoagulation, usually with LMWH or UFH.59 The loading anticoagulant (LMWH or UFH) is continued for at least 5 days until an INR greater than 2 is achieved for at least 24 hours, prior to discontinuing the loading anticoagulant, and first episodes of VTE should be treated with a target INR range of 2.5.79 UFH or LMWH is often discontinued when the INR is greater than 2.0.59
Fondaparinux (arixtra) is similar to LMWH, is monitored using anti–Xa assays, and is often used when individuals need treatment or prophylaxis for VTE but have a history of Heparin-induced thrombocytopenia (HIT).42 The maximal therapeutic dosage is reached in approximately 2-3 hours. Fondaparinux is also used for thrombo-prophylaxis in medical and surgical patients as is LMWH.60

Both UFH and LMWH are associated with HIT, defined as an immune mediated reaction to heparins. HIT can occur in 2%-3% of patients treated with UFH and approximately 1% of patients treated with LMWH.42 HIT will result in a paradoxical increased risk for venous and arterial thrombosis and this risk lasts approximately for 100 days following initial reaction. Therefore, patients with a history of HIT should not receive either LMWH or UFH with subsequent VTE.42,83 Treatment for anticoagulation in individuals with HIT involves using Fondaparinux or other thrombin specific inhibitors such as Lepirudin or Argatroban (Refer to Table 10 for more information on HIT).

Mobility decisions with an individual receiving Coumadin are based upon the initial anticoagulant and not Coumadin. Concern regarding exercise and out of bed activity should be raised for elevated INRs greater than 4 when patients are taking warfarin.84 If the INR is between 4.0 and 5.0, resistive exercises should be avoided, with participation in light exercise only (e.g. Ratings of Perceived Exertion or RPE equal to or less than 11) due to increased risk of bleeding.84 Ambulation should be restricted if gait is unsteady to prevent falls.84 The likelihood of bleeding rises steeply as INR increases above 5.0.85-87 If INR is greater than 5.0, discussion should be held with the referring physician regarding patient safety. When the INR is greater than 6.0, the medical team should consider bed rest until the INR is corrected.84,85 In most cases, INRs can be
corrected within 2 days. When reversal of anticoagulation is needed for surgery and the patient is taking Coumadin, fresh frozen plasma is the choice to replace the anticoagulation.

New oral anticoagulant drugs (direct thrombin inhibitors and direct factor Xa inhibitors) are growing in popularity due to their ease of use (no laboratory monitoring, no adverse dietary or other drug interactions) and their rapid time to peak therapeutic levels. In addition, there appears to be less risk of cerebral hemorrhage as occurs in vitamin K antagonists. Rivaroxaban (Xarelto), dabigatran (Pradaxa) and apixaban (Eliquis) are the three new oral anticoagulant drugs in use at this time (Refer to Table 9 for dosage, method of delivery and peak therapeutic level time frames). The new oral anticoagulant drugs are recommended by the American Association of Orthopedic Surgeons (AAOS) for hip and knee arthroplasty, but have not been tested or recommended for individuals who have cancer, are undergoing treatment for cancer, or who are pregnant. There are concerns regarding reversal of anticoagulation with these medications. However, reconstructed recombinant factor Xa or activated charcoal have both been proposed as antidotes. The time for reversal is the amount of time to eliminate the drug from the body which is based on their half-life, usually within 12-24 hours. With all anticoagulants there is a risk of bleeding. Therefore, in addition to the risk of venous thromboembolism, physical therapists should be aware of and assess for risk of bleeding in all patients (Refer to Table 11 for factors associated with high risk of bleeding).

Action Statement 8: MOBILIZE PATIENTS WHO ARE AT A THERAPEUTIC LEVEL OF ANTIMOBILIZE PATIENTS WHO ARE AT A THERAPEUTIC LEVEL OF ANTI

When a patient has a recently diagnosed LE DVT, physical therapists should initiate mobilization when therapeutic threshold levels of anticoagulants have been reached. (Evidence Quality: I, Recommendation. Strength: Strong)
Action Statement Profile

Aggregate Evidence Quality: Level 1

Benefit: Decreased risk of subsequent LE DVT or PE; decreased risk of adverse effects of bed rest.

Risk, Harm, Cost: Risks associated with use of anticoagulants include increased risk of bleeding. If an anticoagulant is not at a therapeutic level, there may be an increased risk of PE with mobilization.

Benefit-Harm Assessment: Preponderance of benefit

Value Judgments: The evidence for mobility to prevent venous thromboembolism is strong, although the evidence on when to initiate mobility may not be as strong and is based upon the patient achieving the therapeutic level of the anticoagulant. Physical therapists should mobilize patients as soon as possible after diagnosis of venous thromboembolism as long as the risk of PE is decreased. Achieving the therapeutic level of the anticoagulant has been shown to diminish the risk of developing a PE.

Intentional Vagueness: Specific anticoagulants or their therapeutic levels are not recommended. Instead, evidence-based guidelines and algorithms have been provided for guidance. Physical therapists should work within their healthcare system to develop institution-specific protocols.

Role of Patient Preference: Patients should be aware of the anticoagulation they are prescribed and the effect that the anticoagulant will have on their lifestyle (amount of medical monitoring, risk of bleeding, foods to avoid, risk of brain bleed, etc.) In addition, patients should be informed regarding the risk of immobility in developing further VTE, and the benefit of mobility.

Exclusions: The risk of bleeding is present when anyone takes anticoagulants. However, those with HIT, a history of HIT, recent bleeding events, or increased risk of bleeding should be prescribed treatment other than anticoagulation including mechanical compression or intravenous filters.

Summary of Evidence

Patients who have a documented LE DVT and have reached therapeutic levels of the prescribed anticoagulant should be mobilized out of bed and ambulate to prevent venous stasis.

In doing so, deconditioning is minimized, length of hospital stay may be shortened, and other adverse effects of prolonged bed rest (e.g. decubiti) can be avoided. A common concern for mobilizing a patient with a LE DVT is that the clot will dislodge and embolize to the lungs causing a potentially fatal PE. However, early ambulation has been shown to lead to no greater risk of LE
DVT than bed rest for those with a diagnosed LE DVT who have been treated with anticoagulants.27

A meta-analysis found the absence of a higher risk of new PE or other adverse clinical events when individuals were ambulated instead of kept on bed rest.27 The studies included in this meta-analysis had differences in the timing of ambulation following initiation of anticoagulation. Nevertheless, the conclusion arrived at was that “early” ambulation was possible as soon as the level of effective anticoagulation had been reached.27 In two earlier systematic reviews, one with three studies totaling 300 patients (REF 90) and one with 9 studies (ref 22) similar conclusions were reported. A potentially reduced risk for extension of a proximal LE DVT and reduced long term symptoms of PTS with early mobility was reported, demonstrating the benefits of early mobilization of patients having LE DVT.28

In 2012, the ACCP published guidelines on antithrombotic therapy and prevention of thrombosis provided a moderate strength recommendation that patients with an acute LE DVT should receive early ambulation over initial bed rest because of the potential to decrease PTS and improve quality of life.26

In summary, early mobilization of anti-coagulated patients with a LE DVT does not put the patient at increased risk of PE. In fact, early mobilization has added benefits. The GDG recommends mobilizing patients with a LE DVT once anticoagulation is initiated and therapeutic levels have been achieved. Based upon the evidence that exists on time to peak therapeutic levels of the anticoagulants (Refer to Table 9), expert consensus exists to recommend early ambulation
of individuals with LE DVT who are receiving anticoagulation and have reached their peak therapeutic levels based upon the specific anticoagulation medication they are prescribed.

**Action Statement 9: RECOMMEND MECHANICAL COMPRESSION FOR PATIENTS WITH LE DVT.**

Physical therapists should recommend mechanical compression (e.g. intermittent pneumatic compression &/or graduated compression stockings) when a patient has a LE DVT. (Evidence Quality: II; Recommendation Strength: Moderate)

**Aggregate Evidence Quality:** Level II  
**Benefit:** Secondary prevention of recurrent DVT/PE or PTS and faster resolution of LE DVT signs and symptoms.  
**Risk, Harm, Cost:** Improper fit can lead to skin irritation, ulceration, or interruption of blood flow.  
**Benefit-Harm Assessment:** Preponderance of benefit over harm  
**Value Judgments:** None  
**Intentional Vagueness:** Type(s) of mechanical compression were not recommended. Physical therapists should work within their healthcare system to develop institution-specific protocols.  
**Role of Patient Preference:** Ease of use, comfort-level, and/or ability to operate mechanical compression equipment properly should be discussed with patients and their families or caregivers.  
**Exclusions:** Patients who have severe peripheral neuropathy, arterial insufficiency, dermatologic diseases, or lesions may have contraindications to selective mechanical compression modes.

**Summary of Evidence**

In the 9th edition (2012) CPG by the ACCP, recommendations pertaining to mechanical compression based on moderate quality data for patients with diagnosed LE DVT were given. For patients with acute symptomatic LE DVT and in those having PTS, graduated compression stockings (GCS) were suggested based on studies using at least 30 mmHg pressure at the ankle; in patients with severe PTS of the leg not adequately relieved with GCS, a trial with IPC was suggested.

Systematic reviews pertaining to the adjuvant use of mechanical compression
garments for anti-coagulated patients having acute VTE (e.g. LE DVT) while on bed rest or with early ambulation compared to controls provide supportive evidence for their use. The seven RCTs in these reviews concluded that mechanical compression lowered the relative risk for progression of a thrombus or the development of a new thrombus.

Two earlier RCTs conducted on patients over 2 years who had symptomatic, first occurrence proximal LE DVTs, concluded that knee-length elastic GCS with interface pressures of 30-40 mmHg at the ankle reduced the incidence of mild, moderate, and severe PTS compared to controls who did not wear GCS. In stark contrast, a more recent randomized placebo-controlled multi-center trial with 410 patients having a first proximal LE DVT followed for 2 years (i.e. SOX trial) did not support the routine wearing of GCS (i.e. knee length at 30-40 mmHg compared to < 5 mmHg placebo knee- length stockings) after LE DVT.

Two additional RCTs on anti-coagulated patients having acute LE DVT combined early ambulation with the wearing of either inelastic-rigid stockings above the knee (i.e. zinc plaster UNNA boots providing 50 mmHg interface pressure at the ankle) or thigh-length elastic stockings (i.e. providing an interface pressure of 30 mmHg at the ankle) compared to control patients on bed rest. The combination of GCS with ambulation resulted in a faster resolution of pain and swelling, an increased quality of life outcome measure (by questionnaire).

In summary, the evidence to support mechanical compression methods as effective treatment interventions for secondary VTE prevention varies according to patient VTE risk profile, acute (e.g. hemodynamic stability) versus chronic (e.g. post-thrombotic syndrome concern) status, degree of signs (e.g. swelling) and symptoms (e.g. pain), as well as
consideration for potentially harmful outcomes (e.g. skin lesions). Whether used adjunctively along with anticoagulants, alone as in patients when anticoagulant use is contraindicated, or in combination (e.g. ambulation plus GCS) with or without anticoagulation, mechanical compression use has mostly been favorable. Controversy persists, however, whether to support the routine use of mechanical compression (e.g. GCS) for LE DVT management and secondary prevention. Studies do tend to suggest that having GCS compression forces at the ankle, whether elastic or rigid, is beneficial when greater than or equal to 30 mmHg, especially when combined with early ambulation. Whether the mode of mechanical compression is by GCS and/or another (e.g. IPC), the optimal mechanical compression treatment strategy has yet to be identified.97

Action Statement 10: MOBILIZE PATIENTS POST INFERIOR VENA CAVA (IVC) FILTER PLACEMENT ONCE HEMODYNAMICALLY STABLE.

Physical therapists should mobilize patients post IVC filter placement once they are hemodynamically stable and there is no bleeding at the puncture site. (Evidence Quality: V; Recommendation Strength: P-Best Practice)

Action Statement Profile
Aggregate Evidence Quality: Level V
Benefits: Decreased risk of PE, reduced in-hospital fatality rate in stable and unstable patients
Risk, Harm, Cost: IVC complications and potential overuse of IVC filters may increase costs
Benefit-Harm Assessment: Preponderance of benefit over harm for patients who have an acute proximal LE DVT and contraindications to anticoagulants.
Value Judgments: An IVC filter is valuable for high risk patients who are unable to be given anticoagulants
Intentional Vagueness: None
Role of Patient Preference: None
Exclusions: Patients with contraindications to IVC filter placement

Summary of Evidence
Inferior Vena Cava (IVC) filter placement is a type of percutaneous endovascular intervention for venous thromboembolic disease, and is usually performed by an interventional radiologist. Venous access is via the right internal jugular or right femoral veins. The best placement location for the IVC filter to prevent lower extremity and pelvic VTE is just inferior to the renal veins.98 Table 12 lists the indications and contraindications for IVC filter placement. In general, IVC filters are used to prevent PE in patients who are thought to be at high risk for LE DVT or PE, have contraindications to anticoagulants, or for whom medications have not been effective. Findings are mixed regarding the effectiveness of IVC filters in preventing PE and there are risks associated with IVC filter placement (Refer to Table 13). Following placement of an IVC filter, the patient should be mobilized once the patient is hemodynamically stable and there is no bleeding at the puncture site.98 Physical therapists should monitor ambulation and mobility to ensure patient safety and to determine the appropriate level of required assistance prior to the patient being discharged.98

Action Statement 11: CONSULT WITH THE MEDICAL TEAM WHEN A PATIENT IS NOT ANTICOAGULATED OR WITHOUT AN IVC FILTER.

When a patient with a documented LE DVT below the knee is NOT treated with anticoagulation and does NOT have an IVC filter and is prescribed out of bed mobility by the physician, the physical therapist should consult with the medical team regarding mobilizing versus keeping the patient on bed rest.

(Evidence Quality: V; Recommendation Strength: P – Best Practice)

Action Statement Profile

Aggregate Evidence Quality: Level V
Benefits: Mobility has demonstrated a decreased risk of VTE
Risk, Harm, Cost: Potential increased risk of PE should the LE DVT embolize
Benefit-Harm Assessment: Preponderance of benefit over harm
Value Judgments: As movement specialists, physical therapists recommend mobilization over bed rest due to the documented benefits of early mobilization.
Intentional Vagueness: Specific guidelines are not provided because it is rare that a patient will not have anticoagulants prescribed or an IVC filter in this country. Each patient should be considered individually.

Role of Patient Preferences: Patients should be informed of the risks and benefits of bed rest/inactivity and of mobilization.

Exclusions: Any LE DVT present above the knee

Summary of Evidence

There may be times when a patient has a diagnosed LE DVT but no medical interventions are initiated. The patients may have contraindications for receiving anticoagulant medications or they do not meet the criteria for an IVC (e.g. in Palliative Care or Hospice Care). In these situations, a consult with the primary physician or medical team should guide the decision to mobilize the patient. Continuing to remain on bed rest will only increase the risk of additional VTE and other adverse effects of immobilization. At some point, the patient needs to return to daily activities and it might be appropriate to begin mobilization even though an untreated LE DVT is present. In other situations, the reason for not addressing the LE DVT may be short term. It may be wise to wait until anticoagulation can begin. The physical therapist needs to discuss all of these factors with the inter-professional team and the patient when making a clinical judgment about mobilization.

Although a physician may order physical therapy to increase the physical activity level of a patient, it is the physical therapist’s clinical decision whether or not to mobilize the patient based upon the available information about the patient’s LE DVT and risk status.

Action statement 12: SCREEN FOR FALL RISK.

Physical therapists should screen for fall risk whenever a patient is taking an anticoagulant medication. (Evidence Quality: III; Recommendation Strength: Weak)
Action Statement Profile

**Aggregate Evidence Quality:** Level III  
**Benefits:** Decreased risk of hemorrhage due to falls  
**Risk, Harm, Cost:** Immobility versus risk of falling  
**Benefit-Harm Assessment:** Preponderance of benefit over harm  
**Value Judgments:** Fall prevention is a prudent step in managing patients who are at increased risk for bleeding  
**Role of Patient Preference:** None  
**Exclusions:** None  

Summary of Evidence

A major bleed event is a common complication in patients taking an anticoagulant medication. Use of oral anticoagulants increases the risk of intracerebral bleeds by 7-10 times. Individuals who fall while on long term anticoagulation have higher rates of mortality than those not on these medications due to a subsequent major bleed. However, the benefits of being on an anticoagulant outweigh the risk of a major bleed. Because of this, patients at high risk for falls are not automatically excluded from receiving anticoagulants and will receive these medications when it is considered medically beneficial.

Age is considered a major risk factor for falls. Those 75 years and older have the highest rate of falls and one in three individuals over the age of 65 fall each year. Because of the risk of falls associated with age, the National Institute for Health and Care Excellence, the American Geriatric Society, and the US Preventive Services Task Force all recommend screening for fall risk in all older adults. Individuals should be asked about feelings of unsteadiness and falls over the last year. If there has been a fall or unsteadiness reported, further assessment of strength, balance, and other risk factors should be completed. In general, the population of individuals on anticoagulants is made up of older adults who would benefit from fall risk
screening. The Center for Disease Control and Prevention’s (CDC) Stopping Elderly Accidents, Deaths and Injuries (STEADI) toolkit provides physical therapists and inter-professional team members with an evidence based tool to improve fall prevention in clinical practice.

Action Statement 13: RECOMMEND MECHANICAL COMPRESSION WHEN SIGNS AND SYMPTOMS OF POST THROMBOTIC SYNDROME (PTS) ARE PRESENT.

Physical therapists should recommend mechanical compression (e.g. IPC and/or GCS ) when a patient has signs &/or symptoms suggestive of PTS. (Evidence Quality: I; Recommendation Strength: Strong)

Action Statement Profile

Aggregate Evidence Quality- Level I
Benefit- Faster resolution of LE DVT signs and symptoms and decreasing PTS severity.
Risk, Harm, Cost: Improper fit can lead to skin irritation, ulceration, and interruption of blood flow.
Benefit-Harm Assessment: Preponderance of benefit over harm
Value Judgments: None
Intentional Vagueness: The specific type(s) of mechanical compression was/were not recommended. Physical therapists should work within their healthcare system to develop institution-specific protocols.
Role of Patient Preference: Ease of use, comfort-level, and/or ability to operate mechanical compression equipment properly should be discussed with the patient and/or care-giver.
Exclusions: Patients who have severe peripheral neuropathy, arterial insufficiency, dermatologic diseases, or lesions may have contraindications to selective mechanical compression modes.

Summary of Evidence

Approximately one in three patients with LE DVT will experience PTS within five years and in 5-10% of these patients, PTS occurs in its most severe form as venous ulceration. The potential exists that should infection develop, septicemia and/or septic shock could result. Patients with PTS experience chronic complaints of leg pain secondary to the DVT which may include the sense of the leg feeling heavy, cramping, itching, and in severe cases, venous
The pathogenesis of PTS is thought to be related to venous hypertension. As the thrombus initiates an inflammatory response, venous valves may become damaged during this process of thrombus resolution which is often incomplete over time. The damaged venous valves cause valvular reflux and as remodeling of the vein wall occurs, they may become stiff and contribute to increased outflow resistance which increases blood pressure in the veins. This increase in transluminal pressure causes leakage into the interstitial space leading to edema and skin changes. Microcirculation and blood supply to the leg muscles becomes compromised, which can lead to venous ulcerations in the more severe instances of PTS. With clinical findings of PTS being similar to that of an acute LE DVT, concern is raised regarding the negative impact that PTS may have on a person’s quality of life experience. For reasons described above, physical therapists should consider screening all patients with a history of LE DVT, past and current, for signs and symptoms of PTS. Once PTS is suspected, a specific and sensitive rating instrument referred to as the Villalta scale can be used to grade the severity of PTS.

A meta-analysis conducted on 5 RCTs, determined that venous compression stockings or compression bandages are effective in reducing PTS in patients. In patients receiving GCS with LE DVT compared to controls, mild-to-moderate PTS occurred in 64 of 296 (22%) treated with venous compression, compared with 106 of 284 (37%) in controls. Severe PTS occurred in 14 of 296 (5%) treated, compared with 33 of 284 (12%) controls. Development of any degree of PTS occurred in 89 of 338 (26%) treated, compared with 150 of 324 (46%). Thus, GCS reduces the severity of PTS although there was a wide variation in the type of stockings used, time interval from diagnosis to application of stockings, and duration of treatment.
Two Cochrane reviews, separated by one year, were conducted to determine the treatment interventions of IPC or GCS according to PTS severity. Findings from the first review based on two RCTs\textsuperscript{111} included favorable trends using higher pressures of IPC over that of lower pressures and that there was not enough evidence to support the use of elastic GCS (30-40 mmHg pressures at the ankle versus placebo stockings) in patients having mild to moderate PTS severity. The second review based on three RCTs\textsuperscript{119} provided statistically significant evidence that elastic GCS of 20-40 mmHg interface pressure at the ankle reduce the severity of PTS after LE DVT.

A separate RCT involving 169 patients with a first or recurrent proximal LE DVT after receiving 6 months of standard treatment to wear GCS or not was conducted.\textsuperscript{120} The incidence of PTS was 11 patients (13.1%) in the treatment group compared with 17 (20.0%) in the control group. No venous ulceration was observed in either group with symptom relief significantly in favor of compression treatment during the first year but not thereafter. The conclusion reached was that prolonged use of GCS after proximal deep vein thrombosis significantly reduces symptoms and signs of post-thrombotic skin changes.

In the evidence-based guideline by the Finnish Medical Society Duodecim, immediate bandaging for compression during the acute phase of DVT (up to the groin if needed) is recommended in circular rather than figure eight turns.\textsuperscript{30} In addition, the patient should be mobilized as soon as clinically possible, and GCS (Class II compression) should be worn for at least two years.

Pooled results from 4 RCTs in another Systematic review\textsuperscript{121} in patients with confirmed proximal LE DVT, used compression bandaging (inelastic or elastic) with or without early
ambulation, as an intervention for PTS.\textsuperscript{121} Results stressed the importance of activating the calf muscle pump (CMP) in addition to compression bandaging, a message echoed by others more recently.\textsuperscript{122}

The lack of uniformity in reporting standards, such as the timing, duration, degree of compression interface pressure, among other descriptors, makes it difficult for meaningful comparisons between studies. This concern has been raised by more than one investigative group.\textsuperscript{97, 121-124}

In summary, mechanical compression (e.g. with IPC or compression bandaging and/or activation of the CMP), with or without ambulation, is the cornerstone in the treatment of PTS. The intervention strategy is primarily focused on decreasing venous pressure in the involved lower extremity, enhancement of the microcirculation, and reduction of the edema. The efficacy in treating PTS after confirmed acute LE DVT, its development during the sub-acute period, or as a debilitating chronic condition thereafter, does favor the early application and prolonged use of mechanical compression. The lack in uniformity of the methods and prescriptive protocols followed in the use of mechanical compression lends itself to controversy. Nevertheless, the preponderance of quality evidence does warrant a strong recommendation.

**Action Statement 14: PROVIDE MANAGEMENT STRATEGIES TO PREVENT RECURRENT VTE AND MINIMIZE SECONDARY VTE COMPLICATIONS**

Physical therapist should monitor patients who may develop long term consequences of VTE (e.g. LE DVT recurrence; PTS severity) and provide management strategies in order to improve quality of life. (Evidence quality: V; Recommendation strength: P Best Practice)

**Action Statement Profile**

**Aggregate evidence quality:** Level V  
**Benefit-** Decreasing the incidence of LE DVT recurrence; and, minimize the severity of PTS signs
and symptoms in order to enhance functional mobility and a person's quality of life experience.

**Risk, Harm, Cost:** Improper fit of mechanical compression can lead to skin irritation, ulceration, and interruption of blood flow.

**Benefit-Harm Assessment:** Preponderance of benefit over harm

**Value judgments:** None

**Intentional Vagueness:** The specific type(s) of mechanical compression were not recommended. Physical Therapists should work within their healthcare system to develop institution-specific protocols.

**Role of Patient Preference:** Ease of use, comfort-level, and/or ability to operate mechanical compression equipment properly.

**Exclusions:** Patients who have severe peripheral neuropathy, arterial insufficiency, decompensated heart failure, dermatologic diseases, or lesions may have contraindications to selective mechanical compression modes.
Summary of Evidence

Whether or not a VTE (i.e. LE DVT; PE; PTS) has a clear cause (e.g. surgery; trauma; forced immobilization) or is unprovoked (i.e. in the absence of a known risk factor), physical therapists should remain vigilant in screening patients for signs and symptoms of recurrent VTE.\textsuperscript{125} It is estimated that the risk of recurrence can reach 5 to 10 percent during the first 6-12 months\textsuperscript{126} and 10% to 30% within five years\textsuperscript{127} following a documented first-episode VTE. According to one recent CPG, the rate of VTE recurrence for patients not on long term anticoagulation is 5% per year.\textsuperscript{35} When pharmacologic anticoagulation is provided, the recurrence rate for VTE within the first 6 months is reported to be less than 2.5% in one RCT\textsuperscript{128} and between 1.3%-7.1% over a period of 18-24 months in another RCT.\textsuperscript{129} Nevertheless, the incidence of fatal and non-fatal VTE recurrence in patients who are anti-coagulated following confirmed VTE in the short term of 3 months was reported to be 0.4% and 3%, respectively, in one meta-analysis\textsuperscript{130} and fatality incidence due to PE of 1.68% in a large cohort study.\textsuperscript{131} These findings serve to underscore the importance of having physical therapists monitor patients for VTE recurrence whether over the short- or long-term.

The ability of a clinician to accurately predict level of risk for recurrent VTE (e.g. low versus high) has been investigated using the Pulmonary Embolism Severity Index (PESI) clinical prediction rule and found to be of merit.\textsuperscript{128,132} Additionally, the use of global clinical judgment that takes into account all of a patient’s signs and symptoms (i.e. unstructured clinician Gestalt) may be superior to clinical prediction rule use.\textsuperscript{129}

The ability to distinguish or recognize that PTS is present is important for the clinician to determine. PTS is defined as a combination of clinical signs and symptoms occurring after a LE
DVT. One study examined 6 different scoring systems that are intended to document the presence and severity of PTS based on variable clinical signs (i.e. eleven) and symptoms (i.e. twelve) used between them. Since PTS also involves a patient’s subjective report of symptoms, using the objective PTS indicator of skin pigmentation changes that highly correlate with findings from duplex sonography for venous-reflux occlusion, was advocated.

Thrombosis resolution is often incomplete with as many as 50% of legs affected by DVT still having residual vein thrombosis years after the LE DVT is first diagnosed. The negative impact on generic life-quality measures (e.g. SF-36 Health Survey sections for physical functioning and bodily pain) has life-quality consequence comparable to chronic medical conditions such as diabetes and heart failure. It is prudent, therefore, that physical therapists recognize signs and symptoms of PTS and intervene with education, hydration, early mobilization, mechanical compression, and referral for medication when appropriate (Refer to Key Action Statement 3). For example, mechanical compression aims to manage factors responsible for the pathogenesis of VTE (i.e. Virchow’s triad of hyper-coagulopathy, venous stasis, and endothelial damage) by reducing swelling, accelerating venous return, and improving muscle pump function.

In summary, patients who have a prior history of VTE are at high risk of recurrent VTE, especially when they are immobilized and/or are of advanced age. It is judicious to screen for VTE recurrence using a clinical prediction rule (e.g. PESI; Padua; Wells’ Criteria for LE DVT; Geneva) for objective documentation purposes, although global clinical judgment that would favor intervention for secondary VTE prevention should not be overlooked. Once VTE is diagnosed, clinical practice has shifted away from immobilization with bed rest and toward early
ambulation with or without adjunctive mechanical compression. From the literature examined, the degree to which recurrent VTE is treated as a secondary prevention should be a priority. Thus, clinical judgment and expert opinion remain for deciding the clinical actions to take.

Conclusion

The major findings of this CPG are the following:

- Physical therapists should play a large role in identifying patients who are high risk of a VTE. Once these individuals are identified, preventive measures such as referral for medication, initiation of activity/mobilization, mechanical compression, and education should be implemented to decrease the risk of a first or reoccurring VTE.

- Physical therapist should be aware of the signs and symptoms of a LE DVT. When signs and symptoms are present, the likelihood of LE DVT should be determined through the Wells’ Criteria for LE DVT and results shared with the inter-professional team to consider treatment options.

- In patients with a diagnosed LE DVT, once a medication’s therapeutic levels or an acceptable time period has been reached post administration, mobilization should begin. While there are risks associated with mobilization, the risk of inactivity is greater.

- Complications following LE DVT can continue for years or even a lifetime. Physical therapists can help decrease these complications through education, mechanical compression, and exercise.

Implementation
In order to implement and disseminate the recommendations of this CPG, the GDG has taken the following steps.

- Preliminary sharing of CPG recommendations at Combined Sections Meeting 2015.
- Open access to the CPG and all reference materials.
- Creation of a Pocket Guide for physical therapist about VTE.
- Creation of patient brochures and information flyers about the role of physical therapists in preventing VTE and managing patients with LE DVT.
- Production of podcasts about the CPG aimed at physical therapists.
- Presentations on the CPG by the GDG at local, state, regional, and national seminars.
- Creation of checklist and sample evaluation forms incorporating the recommendations of the CPG.

All these tools can be found at www.TOBEDEVELOPEDWEBSITE.org and are available for free.

In order to implement these recommendations, physical therapists and the entire healthcare team should take the following steps.

- Integrate key action statements within this paper into clinical practice. Making resources easily accessible in the clinic, such as lists of signs and symptoms of LE DVT, copies of the Wells’ Criteria for LE DVT tool, and the algorithms in this CPG, are several examples.
- Formation of inter-professional teams that address VTE and ensure all providers know about and then implement the recommendations in this CPG. This may be
through embedding risk assessment into standardized examination forms or working with referral sources to encourage early mobilization post diagnoses of VTE. As demonstrated in the areas of early mobilization in the intensive care unit and diabetes and chronic pain management, inter-professional teams are effective when attempting to change the culture of an organization to improve patient outcomes.\textsuperscript{133-135}

- Physical therapists need to seek out membership in these inter-professional committees and serve as clinical champions in the areas of VTE prevention and management. As movement specialists, physical therapists understand the importance of mobilization and activity and have the ability to modify interventions based on medical history and patient problems. Physical therapists can add greatly to the scope and depth of these teams.
Research needs

While researchers have addressed multiple aspects of VTE management, there are still many unanswered questions. The below lists summarizes a few areas of future research questions that are specific to the physical therapy management.

- Does aggressive screening for LE DVT lead to a decline in the incidence of PE?
- Does the implementation of guidelines for mobilization of patients with LE DVT lead to earlier mobilization and improved patient outcomes?
- How should patients with UE DVT be managed by physical therapists?
- What are guidelines for mobilization of individuals with a hemodynamically unstable PE?
- What is the appropriate degree of graded compression (e.g. elastic, inelastic stockings, or IPC) and timing of treatment intervention for PTS and LE DVT prevention?

Conflict of Interest Statement

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Financial Disclosure and Conflicts of Interest

Each of the panel members were asked to disclose any existing or potential conflicts of interest including financial relationships with pharmaceutical, medical device, or biotechnology companies prior to being included in the panel. The panel declared no conflicts of interest.

Disclaimer

This CPG is not intended as the sole source of guidance in managing patients at risk for or diagnosed with VTE. Rather, it is designed to assist clinicians by providing an evidence-based framework for decision-making strategies. This CPG is not intended to replace clinical judgment or establish a protocol for all individuals with this condition and may not provide the only appropriate approach to managing the problem. This CPG may be used to develop policy, suggest policy changes, or may provide discussion about current policy. However, it is up to individual facilities to determine if they wish to adopt these CPG key action statement recommendations in place of their existing policies or protocols.

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### Table 2: Level Of Evidence

<table>
<thead>
<tr>
<th>Level</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Evidence obtained from high-quality diagnostic studies, prognostic or prospective studies, cohort studies or randomized controlled trials, meta-analyses or systematic reviews (critical appraisal score &gt; 50% of criteria)</td>
</tr>
<tr>
<td>II</td>
<td>Evidence obtained from lesser-quality diagnostic studies, prognostic or prospective studies, cohort studies or randomized controlled trials, meta-analyses or systematic reviews (e.g., weaker diagnostic criteria and reference standards, improper randomization, no blinding, &lt;80% follow-up) (critical appraisal score &lt;50% of criteria)</td>
</tr>
<tr>
<td>III</td>
<td>Case-controlled studies or retrospective studies</td>
</tr>
<tr>
<td>IV</td>
<td>Case studies and case series</td>
</tr>
<tr>
<td>V</td>
<td>Expert opinion</td>
</tr>
<tr>
<td>Grade</td>
<td>Recommendation</td>
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<tr>
<td>-------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>A</td>
<td>Strong</td>
</tr>
<tr>
<td>B</td>
<td>Moderate</td>
</tr>
<tr>
<td>C</td>
<td>Weak</td>
</tr>
<tr>
<td>D</td>
<td>Theoretical/ Foundational</td>
</tr>
<tr>
<td>P</td>
<td>Best practice</td>
</tr>
<tr>
<td>R</td>
<td>Research</td>
</tr>
</tbody>
</table>
Table 4: Reduced mobility as a risk factor for VTE\textsuperscript{18, 24}

<table>
<thead>
<tr>
<th>Degree of immobility</th>
<th>OR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited</td>
<td>1.73</td>
<td>1.08-2.75</td>
<td>0.02</td>
</tr>
<tr>
<td>Wheelchair 30 days</td>
<td>2.43</td>
<td>1.37-4.30</td>
<td>0.002</td>
</tr>
<tr>
<td>Bed rest 30 days</td>
<td>2.73</td>
<td>1.20-6.20</td>
<td>0.02</td>
</tr>
<tr>
<td>Wheelchair 15-30 days</td>
<td>3.33</td>
<td>1.26-8.84</td>
<td>0.02</td>
</tr>
<tr>
<td>Bed rest 15-20 days</td>
<td>3.37</td>
<td>1.00-11.29</td>
<td>0.05</td>
</tr>
<tr>
<td>Wheelchair 15 days</td>
<td>4.32</td>
<td>1.50-12.45</td>
<td>0.007</td>
</tr>
<tr>
<td>Bed rest &lt; 15 days</td>
<td>5.64</td>
<td>2.04-15.56</td>
<td>0.0008</td>
</tr>
</tbody>
</table>

OR = Odds ratio; CI = confidence interval

Table 5: Education Topics for Patients at High Risk for DVT\textsuperscript{69}

- Risk factors for DVT
- Possible consequences of DVT
- Interventions to decrease the risk of DVT
- Signs/symptoms of DVT and importance of seeking medical help if suspect DVT
- Importance of follow-up monitoring
- Importance of compliance
- Medication issues e.g. regimen, adverse side effects and interactions, dietary restrictions

Table 6: Definition of Immobility in Residents of Long-Term Care Facilities\textsuperscript{43}
Presence of at least 1 of the following:

- Lower limb cast
- Bedridden
- Bedridden except for bathroom privileges
- Recent decreased ability to walk at least 10 feet for a least 72 hours
- Inability to walk at least 10 feet

Table 7: Signs and Symptoms of a LE DVT 35, 42, 59, 61

- Pitting edema
- Tenderness and pain in leg
- Erythema
- Warmth
- Swelling of the leg
- Prominent superficial veins
### Table 8: Two-Level DVT Wells Score

<table>
<thead>
<tr>
<th>Clinical Feature</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active cancer (treatment ongoing, within 6 months, or palliative)</td>
<td>1</td>
</tr>
<tr>
<td>Paralysis, paresis or recent plaster immobilisation of the lower extremities</td>
<td>1</td>
</tr>
<tr>
<td>Recently bedridden for 3 days or more or major surgery within 12 weeks requiring general or regional anaesthesia</td>
<td>1</td>
</tr>
<tr>
<td>Localised tenderness along the distribution of the deep venous system</td>
<td>1</td>
</tr>
<tr>
<td>Entire leg swollen</td>
<td>1</td>
</tr>
<tr>
<td>Calf swelling at least 3 cm larger than asymptomatic side</td>
<td>1</td>
</tr>
<tr>
<td>Pitting edema confined to the symptomatic leg</td>
<td>1</td>
</tr>
<tr>
<td>Collateral superficial veins (non-varicose)</td>
<td>1</td>
</tr>
<tr>
<td>Previously documented DVT</td>
<td>1</td>
</tr>
<tr>
<td>Alternative diagnosis at least as likely as DVT</td>
<td>−2</td>
</tr>
</tbody>
</table>

**Clinical probability simplified score**

<table>
<thead>
<tr>
<th>DVT ‘likely’</th>
<th>2 points or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVT ‘unlikely’</td>
<td>Less than 2 points</td>
</tr>
<tr>
<td>Classifications and mechanism of action</td>
<td>Medication Names</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Unfractionated Heparin</td>
<td>Heparin</td>
</tr>
<tr>
<td>Mechanism of action:</td>
<td></td>
</tr>
<tr>
<td>inactivates thrombin and activated factor X (factor Xa) by binding to antithrombin through a high-affinity pentasaccharide.</td>
<td></td>
</tr>
<tr>
<td>Low Molecular Weight Heparins</td>
<td>Lovenox (enoxaparin) Fragmin Enoxaparin (ext release) Innnohep (tinzaparin sodium) Others?</td>
</tr>
<tr>
<td>Mechanism of action:</td>
<td></td>
</tr>
<tr>
<td>binds to antithrombin which is mediated by a unique pentasaccharide sequence which causes a change in antithrombin and inactivates factor Xa</td>
<td></td>
</tr>
<tr>
<td>Fondaparinux (synthetic drug)</td>
<td>Arixtra</td>
</tr>
<tr>
<td>Mechanism of action:</td>
<td></td>
</tr>
<tr>
<td>provides antithrombotic activity via selectively binding to antithrombin III (ATIII) which in turn results in inhibition of Factor Xa</td>
<td></td>
</tr>
<tr>
<td>Vitamin K antagonists</td>
<td>Coumadin (warfarin)</td>
</tr>
<tr>
<td>Mechanism of action:</td>
<td></td>
</tr>
<tr>
<td>inhibiting the synthesis of vitamin K-dependent clotting factors, especially the C1</td>
<td></td>
</tr>
</tbody>
</table>
subunit of vitamin K epoxide reductase (VKORC1) enzyme complex

<table>
<thead>
<tr>
<th>Oral direct thrombin inhibitorMechanism of action:Directly inhibits thrombin</th>
<th>Pradaxa (dabigatran)</th>
<th>Delivery: oral Dosing: 150 mg bid</th>
<th>Peak achieved in 2 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral direct Xa inhibitorsMechanism of action: exerts anticoagulant effect via direct inhibition of a single Factor within the coagulation cascade: Factor Xa.</td>
<td>Xarelto (rivaroxaban) Eliquis (Apixaban)</td>
<td>Delivery: oral Xarelto Dosing: 15 mg bid for first 21 days, 20 mg qd after day 21 Eliquis dosing: 5 mg bid</td>
<td>2-3 hours</td>
</tr>
</tbody>
</table>

Table 10: Indicators of Heparin Induced Thrombocytopenia (HIT)

- Skin lesion reaction at injection site
- Systemic reaction to a bolus administration of heparin
- 50% decrease in platelet count from baseline labs while on heparin

Delayed onset HIT:
- thromboembolic complications 1-2 wks after receiving last dose of LMWH or UFH
- mild to moderate thrombocytopenia
Table 11: Risk of Bleeding

- Active bleeding
- Acute stroke
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as Coumadin with an INR >2)
- Lumber puncture/epidural/spinal anesthesia expected to be given within next 12 hours
- Thrombocytopenia (platelets less than 7,500)
- Uncontrolled systolic hypertension (defined as BP of 230/120 mm Hg or higher)
- Untreated inherited bleeding disorders such as hemophilia or von Willebrand’s disease

Table 12: Indications and Contraindications to Inferior Vena Cava Filter Placement

<table>
<thead>
<tr>
<th>Absolute Indications</th>
<th>Relative Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraindication to anticoagulation</td>
<td>Large free-floating proximal DVT</td>
</tr>
<tr>
<td>Therapeutic anticoagulation is unable to be achieved or maintained</td>
<td>Therapeutic anticoagulation not achieved</td>
</tr>
<tr>
<td></td>
<td>VTE with decreased cardiopulmonary reserve</td>
</tr>
<tr>
<td></td>
<td>Poor compliance with anticoagulation medication</td>
</tr>
<tr>
<td></td>
<td>High risk of complication from anticoagulation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Absolute Contraindications</th>
<th>Relative Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete, chronic thrombosis of the IVCF</td>
<td>Severe, uncorrectable coagulopathy</td>
</tr>
<tr>
<td>Inability to gain central venous access</td>
<td>Bacteremia or sepsis</td>
</tr>
</tbody>
</table>

Table 13: Complications Related to Inferior Vena Cave Filters

<table>
<thead>
<tr>
<th>Insertion Complications</th>
<th>Thrombotic Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematoma at insertion site</td>
<td>Insertion site thrombosis</td>
</tr>
<tr>
<td>Misplacement</td>
<td>IVCF thrombosis</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>New or progression of DVT</td>
</tr>
<tr>
<td>IVC damage/wall penetration</td>
<td>New or progression of PE</td>
</tr>
<tr>
<td>Filter migration</td>
<td>Post-thrombotic syndrome</td>
</tr>
<tr>
<td>Air embolism</td>
<td></td>
</tr>
<tr>
<td>Carotid artery puncture</td>
<td></td>
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Figure 2: Screening for Risk of Venous Thromboembolism Algorithm

Is the patient at high risk for VTE? (Table 1 and 6)

YES

No

Interventions to decrease risk (Table 7)
1. Encourage mobility and physical activity
2. Use of mechanical compression
3. Consult with physician about medication
4. Provide education on VTE prevention (Table 9)

Encourage mobility and physical activity
Figure 3: Determining Likelihood of a Lower Extremity Deep Vein Thrombus Algorithm

Does the patient have signs and/or symptoms of a LE DVT? (Table 16)

NO
Continue to encourage mobility and physical activity in addition to any additional preventive interventions

YES
Assess DVT likelihood using the Wells's Criteria for DVT (Table 11)
Communicate signs and symptoms along with results of Wells to medical team

Was a diagnostic test for DVT performed?

YES
If negative, encourage mobility and physical activity
If positive, go to Algorithm 3

NO
Use clinical judgment regarding mobilization
Figure 4: Mobilizing Patients with Known Lower Extremity Deep Vein Thrombus Algorithm

Is the patient anticoagulated?

Yes

LMWH

Fondaparinux

New DVT despite preventive dosage?

Yes

Wait for higher dose to be given

No

Wait for dose to be given

Time since administration

< 3 hrs – No mobility

> 3 hrs – Mobilize

< 3 hrs – No mobility

< 24 hrs – No mobility

2-3 hrs – Check with physician

> 48 hrs – Mobilize

> 3 hrs – Mobilize

> 48 hrs – Mobilize

NOAC

Time since administration

< 2 hrs – No mobility

< 2 hrs – No mobility

2-3 hrs – Check with physician

2-6 hrs – Check with physician

> 3 hrs – Mobilize

INR Levels

INR < 2 - No mobility

INR 2-3 – Mobilize

INR > 5 – Check with physician

No

Do they have an IVC filter?

Yes - Mobilize

No – Check with physician

LMWH – Low Molecular Weight Heparin
UFH – Unfractionated Heparin
NOAC – Novel Oral Anticoagulants
INR – International Normalized Ratio
IVC – Inferior Venae Cava

1 If started on Coumadin, LMWH usually also started. Use LMWH guidelines for mobilization decision in these situations