BRIEF CLINICAL UPDATE

Update on Mechanical Venous Thromboembolism Prophylaxis

Elaine Parker, M.D.

Case Report

Venous thromboembolism (VTE) represents a major US public health issue that impacts 350,000 to 600,000 people with 100,000 associated deaths. VTE is a common cause of preventable hospital death. Patients who are hospitalized or recently hospitalized for acute medical illness or surgery are at risk for deep vein thrombosis (DVT) and pulmonary embolus (PE). Methods of VTE prevention have historically included pharmacologic and mechanical prophylaxis (eg, graduated compression stockings and intermittent pneumatic compression). While intermittent pneumatic compression (IPC) is an effective means of mechanical VTE prophylaxis, the benefit of graduated compression stockings (GCS) is questioned in recent literature.

Recent trials suggest that graduated compression stockings may not be effective in preventing venous thromboembolism. Morris et al[1] reviewed trials comparing GCS and IPC between 1970 and 2008 and reported a cumulative DVT rate of 5.9% with GCS as compared to 2.8% with IPC. Studies in critically ill patients demonstrated lower VTE incidence with IPC versus GCS.[2] In the CLOTS 3 trial, rates of DVT were examined in immobile stroke patients randomized to treatment with or without IPC. DVT occurred less frequently in stroke patients treated with IPC, with an absolute risk reduction of 3.6%.[3] The CLOTS trials found no statistically significant benefit of GCS on VTE or survival.

CLOTS 1 did not show GCS to reduce DVT after stroke when compared to no mechanical prophylaxis.[4] Higher-risk groups, including patients with leg weakness and patients not on concomitant anticoagulation, also did not benefit from GCS. CLOTS 1 and 2 found patients treated with GCS had a small but non-significant increased hazard of death in the first 6 months.[5] CLOTS 2 demonstrated increased proximal VTE with the use of below-the-knee stockings as compared with thigh-high stockings.[6] However, a Cochrane review indicated a dearth of high-quality evidence to distinguish between the efficacy of knee-length and thigh-length graduated compression stockings.[7] In a review of 4 trials including 1,171 orthopedic patients, Patel et al[8] did not find decreased VTE rates when GCS were added to pharmacologic prophylaxis. Some studies in surgical patients have demonstrated the benefit of GCS, and surgical guidelines recommend the use of GCS or IPC as a means of mechanical prophylaxis.[9]

Use of GCS is costly and associated with adverse skin effects. GCS are challenging to fit and properly maintain. There are twenty-eight different sizes of GCS. The calf and thigh circumference must be measured by skilled personnel for appropriate sizing. Incorrect sizing can result in an increased risk of DVT. GCS should be monitored at least 3 times daily for skin breakdown and migration of the stockings. Discomfort and inconvenience may lead to suboptimal compliance. Skin breakdown is common including skin ulcers, breaks, and necrosis. In the CLOTS 1 trial, skin breaks and ulcers were 4 times more common in the group treated with GCS (64 vs. 16%).[4] In the CLOTS 2 trial, skin breakdown occurred in 3.9% of patients treated with thigh-high stockings and 2.9% with below-the-knee stockings.[6] One case reported improperly fitted graduated compression stockings placed during surgery led to lateral leg compartment syndrome.[10]

CHEST guidelines for prevention of VTE include both GCS and IPC as methods of mechanical prophylaxis.[11] Low-risk patients who are ambulatory and/or hospitalized <48 hours should not be prescribed mechanical prophylaxis as this impedes ambulation and can increase risk of falls. Pharmacologic prophylaxis in a low-risk population can increase bleeding risk. Mechanical prophylaxis is indicated when pharmacologic prophylaxis is contraindicated in patients at moderate and high-risk for VTE. All high-risk patients should be treated with mechanical and pharmacologic prophylaxis unless contraindications exist. Based upon CHEST guidelines, critically ill patients can be treated with GCS or IPC. However, these guidelines recommend IPC for orthopedic surgery patients.

With the implementation of the EMR at UCLA in March 2013, VTE prophylaxis ordering was consolidated and standardized. Prior to the EMR, there were multiple orders sets with variability between services. Variable practice patterns were based on different VTE risk assessments and population-specific risk. The EMR provides a VTE prophylaxis order set based upon global VTE risk rather than patient-specific VTE risk factors. IPC, but not GCS, is the standard option for mechanical VTE prophylaxis. A review of the CLOTS trials and other recent studies suggests that use of GCS in non-surgical patients may not be effective and may increase risk of DVT. Moreover, GCS is associated with skin breakdown and cost.

REFERENCES

1. **Morris RJ, Woodcock JP**. Intermittent pneumatic compression or graduated compression stockings for deep vein thrombosis prophylaxis? A systematic review of direct clinical comparisons. Ann Surg. 2010 Mar;251(3):393-6. doi: 10.1097/SLA.0b013e3181b5d61c. Review. PubMed PMID: 20083996.
2. **Arabi YM, Khedr M, Dara SI, Dhar GS, Bhat SA, Tamim HM, Afesh LY**. Use of intermittent pneumatic compression and not graduated compression stockings is associated with lower incident VTE in critically ill patients: a multiple propensity scores adjusted analysis. Chest. 2013 Jul;144(1):152-9. doi:10.1378/chest.12-2028. PubMed PMID: 23412593.
3. **CLOTS (Clots in Legs Or sTockings after Stroke) Trials Collaboration, Dennis M, Sandercock P, Reid J, Graham C, Forbes J, Murray G**. Effectiveness of intermittent pneumatic compression in reduction of risk of deep vein thrombosis in patients who have had a stroke (CLOTS 3): a multicentre randomised controlled trial. Lancet. 2013 Aug 10;382(9891):516-24. doi: 10.1016/S0140-6736(13)61050-8. Epub 2013 May 31. Erratum in: Lancet. 2013 Sep 21;382(9897):1020. Lancet. 2013 Aug 10;382(9891):506. PubMed PMID: 23727163.
4. **CLOTS Trials Collaboration, Dennis M, Sandercock PA, Reid J, Graham C, Murray G, Venables G, Rudd A, Bowler G**. Effectiveness of thigh-length graduated compression stockings to reduce the risk of deep vein thrombosis after stroke (CLOTS trial 1): a multicentre, randomised controlled trial. Lancet. 2009 Jun 6;373(9679):1958-65. doi: 10.1016/S0140-6736(09)60941-7. Epub 2009 May 26. PubMed PMID: 19477503; PubMed Central PMCID: PMC2692021.
5. **CLOTS Trials Collaboration, Dennis M, Sandercock P, Reid J, Graham C, Murray G, Venables G, Rudd A, Bowler G**. The effect of graduated compression stockings on long-term outcomes after stroke: the CLOTS trials 1 and 2. Stroke. 2013 Apr;44(4):1075-9. doi: 10.1161/STROKEAHA.111.680298. Epub 2013 Mar 12. PubMed PMID: 23482600.
6. **CLOTS (Clots in Legs Or sTockings after Stroke) Trial Collaboration**. Thigh-length versus below-knee stockings for deep venous thrombosis prophylaxis after stroke: a randomized trial. Ann Intern Med. 2010 Nov 2;153(9):553-62. doi: 10.7326/0003-4819-153-9-201011020-00280. Epub 2010 Sep 20. Erratum in: Ann Intern Med. 2010 Dec 21;153(12):851. PubMed PMID: 20855784.
7. **Sajid MS, Desai M, Morris RW, Hamilton G**. Knee length versus thigh length graduated compression stockings for prevention of deep vein thrombosis in postoperative surgical patients. Cochrane Database Syst Rev. 2012 May16;5:CD007162. doi: 10.1002/14651858.CD007162.pub2. Review. PubMed PMID:22592717.
8. **Patel N, Khakha R, Gibbs J**. Review article: Anti-embolism stockings. J Orthop Surg (Hong Kong). 2013 Dec;21(3):361-4. PubMed PMID: 24366800.
9. **Roderick P, Ferris G, Wilson K, Halls H, Jackson D, Collins R, Baigent C**. Towards evidence-based guidelines for the prevention of venous thromboembolism: systematic reviews of mechanical methods, oral anticoagulation, dextran and regional anaesthesia as thromboprophylaxis. Health Technol Assess. 2005 Dec;9(49):iii-iv, ix-x, 1-78. Review. PubMed PMID: 16336844.
10. **Hinderland MD, Ng A, Paden MH, Stone PA**. Lateral leg compartment syndrome caused by ill-fitting compression stocking placed for deep vein thrombosis prophylaxis during surgery: a case report. J Foot Ankle Surg. 2011 Sep-Oct;50(5):616-9. doi: 10.1053/j.jfas.2011.04.025. Epub 2011 May 26. PubMed PMID: 21616687.
11. **Guyatt GH, Akl EA, Crowther M, Gutterman DD, Schuünemann HJ**; American College of Chest Physicians Antithrombotic Therapy and Prevention of Thrombosis Panel. Executive summary: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest. 2012 Feb;141(2 Suppl):7S-47S. doi: 10.1378/chest.1412S3. Erratum in: Chest. 2012 Dec;142(6):1698. Dosage error in article text. Chest. 2012 Apr;141(4):1129. Dosage error in article text. PubMed PMID: 22315257; PubMed Central PMCID: PMC3278060.

Submitted on September 8, 2014