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Short Communication Open Access

Intermittent Pneumatic Compression from a Surgical Perspective

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Abstract

Despite pharmacological prophylaxis, 50% of the surgical patients whose Caprini score is >10 develop VTE in the postoperative period suggesting that anticoagulation alone may not be sufficient especially in these high-risk patients. Clinical studies demonstrate that the clot nidus starts to form during the time of operation. Thus, in the postoperative period when pharmacological prophylaxis is initiated, high-risk patients may have already developed a blood clot for which prophylactic doses of anticoagulants would be suboptimal to treat. Therefore, VTE prophylaxis should start at the time of anesthesia induction. Due to bleeding risks associated with pharmacological agents, mechanical modalities, i.e. intermittent pneumatic compression (IPC) devices, with their proven effectiveness in reducing VTE in trauma and high bleeding-risk patients are invaluable tools that should be utilized during surgery frequently. They should be started in the beginning of the operation and then continued together with pharmacological prophylaxis in the postoperative period until full ambulation. Furthermore, there is strong evidence that application of IPCs to any limb, including foot and arm, is sufficient for their prophylactic effect making them suitable for almost any type of surgery. In conclusion, combined pharmacological and mechanical prophylaxis should be utilized more frequently in surgical patients who have high risk for VTE.

Keywords: IPC; LMWH; VTE; Prophylaxis

Short Communication

In the surgical setting, venous thrombo-embolism (VTE) occurs in 14.5% patients when prophylaxis is not employed [1]. The incidence is reduced to 4.2% with pharmacological prophylaxis, and further to 0.6% when mechanical prophylaxis modalities are combined with pharmacological methods [2]. VTE prophylaxis is conceptually based on gradual risk assessment. One of the most clinically relevant and useful tools for this assessment is the Caprini Score [3] (Table 1). This consists of various medical and surgical conditions, and is primarily designed to screen for any given patient being admitted to a hospital ward. Patients are allocated the relevant risk points for each of the existing conditions. The risk is classified per 9th edition of American College of Chest Physicians (ACCP) guidelines into four categories: very low (0 points); low (1-2 points); moderate (3-4 points) and high (≥5 points) [4].

1 point	2 points	3 points	5 points
Age 41-60 years	Age 61-74 years	Age ≥ 75 years	Stroke (<1 month)
Minor surgery	Arthroscopic surgery	History of VTE	Elective arthroplasty
BMI > 25 kg/m2	Major open surgery (>45 minutes)	Family history of VTE	Hip, pelvis or leg fracture
Swollen legs	Laparoscopic surgery (>45 minutes)	Factor V Leiden	Acute spinal cord injury (<1 month)
Varicose veins	Malignancy	Prothrombin 20210A	
Pregnancy or postpartum	Confined to bed (>72 hours)	Lupus Anticoagulant	
History of recurrent or spontaneous abortion	Immobilizing plaster cast	Anticardiolipin antibodies	
Oral contraceptives or hormone replacement	Central venous access	Elevated serum homocysteine	
Sepsis (<1 month)		Heparin-induced thrombocytopenia	
Serious lung disease, including pneumonia (<1 month)		Other congenital or acquired thrombophilia	

Abnormal pulmonary function			
Acute myocardial infarction			
Congestive heart failure (<1 month)			
History of inflammatory bowel disease			
Medical patient at bed rest			

Table 1: Caprini risk assessment model*. * Modified from Ref [3].

The subsequent management following VTE risk allocation is primarily dictated per the patients bleeding risk at the time of hospitalization [5]. The definition of bleeding risk is rather vague, and is at the discretion of the attending physician. The 9th ACCP guidelines recommend mechanical prophylaxis or intermittent pneumatic compression (IPC) devices alone for low to moderate risk patients. Combined prophylaxis methods (pharmacological + mechanical) are recommended for moderate/high risk surgical patients (especially cancer surgery) when bleeding is low (≤1%).

When the bleeding risk is esteemed high (≥2%), mechanical prophylaxis with IPC devices is the modality of choice. IPC devices are applied with elastic compression stockings to enhance their VTE risk reduction potential [6]. For patients undergoing surgery, IPC devices are applied during the induction of anesthesia and continued until full ambulation is restored. This allows for a more liberal use in a number of situations such as emergency surgery and trauma. Additionally, in major abdominal cancer surgery, an unexpected major bleed may result in delayed administration of LMWH in the post-operative period, and mechanical prophylaxis contributes to offset the VTE risk incurred in these patients. Even though not overt and usually overseen, the preoperative administration of LMWH may result in slightly increased bleeding from dissection sites, which may distress the operating surgeon in a difficult anatomy.

Initial VTE prophylaxis using IPC devices in surgical patients seems most feasible and efficient for: (1) moderate-high VTE risk major abdominal surgery and (2) high bleeding risk in any given patient. One of the crucial components of VTE prophylaxis is a periodic check for a change in VTE/bleeding risk balance during certain phases of hospitalization. Therefore, LMWH are administered as soon as the bleeding risk subsides. When full ambulation is restored, IPC are stopped and prophylaxis is continued with LMWH until discharge. Based on two landmark trials, the ENOXACAN-II and FAME trials, it is currently standard practice to administer an extended prophylaxis with LMWH for 4 weeks following hospital discharge in patients having undergone cancer surgery [7,8].

In the trauma setting, with a high bleeding risk, IPC is the preferred method. Inferior vena cava filters are not recommended for primary VTE prophylaxis in trauma patients [5]. Foot pumps are extremely valuable, to be applied immediately for initial 48 hours; followed by a daily duplex scan until bleeding risk subsides.

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