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REVIEW

Early ambulation and prevention of post-operative thrombo-embolic risk



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Summary The prevention of post-operative risk of venous thrombo-embolism (VTE) is of fundamental importance, but preventive methods have progressed with the introduction of direct oral anticoagulants (DOAC), the development of ambulatory surgery and enhanced recovery programs (ERP) after surgery. Surgery is, inherently a trigger for venous thrombo-embolic disease, as is prolonged immobilization. However, the risk of VTE is very low following ambulatory surgery, especially in this selected population. ERP, consists of a set of measures to optimize the patient's peri-operative management while reducing length of stay, costs and morbidity and mortality; one measure is the encouragement of early ambulation. This will undoubtedly have an impact on the incidence of VTE and lessen the need for prolonged thrombo-prophylaxis.
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Post-surgical VTE has an incidence of 1% [1], and one-third of VTE patients develop pulmonary embolism resulting in significant post-operative morbidity and mortality; the management of thrombo-prophylaxis has evolved with the introduction of direct oral anticoagulants (DOAC) but also the development of enhanced recovery after surgery (ERP), or so-called "fast-track surgery". ERP is defined as a unified approach to comprehensive peri-operative patient care, aiming at rapid recovery of previous physical and mental capacities and a consequent reduction of morbidity, mortality and length of stay.

The classic triad of Virchow, defined by the combination of venous stasis, endothelial alteration and a hypercoagulable state, is universally present post-operatively explaining a higher incidence of VTE than is seen in the general population [2]. It is important to assess each patient's risk and the surgery-specific risk. Risk can be stratified into several groups: low, moderate, and high [3]. Scores have even been created such as the Caprini score (Table 1) [4] or Rogers score [5], yet they are complicated to use. The situations that significantly increase VTE risk, regardless of the type of surgery, include (Table 2): a prior history of VTE, familial major thrombophilia, cancer, chemotherapy, cardiac or

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Table 1 Caprini score.

1 point	2 points	3 points	5 points
Age 41–60 years	Age 61–74 years	Age \geq 75 years	Stroke (<1 month)
Minor surgery	Arthroscopic surgery	Prior history of DVT	Elective joint replacement
BMI > 25 kg/m ²	Major surgery (>45 min)	Family history of DVT	Pelvic, hip, or leg fracture
Lower extremity edema	Laparoscopic surgery (>45 min)	Factor V Leyden	Spinal cord injury (<1 month)
Varicose veins	Cancer	Factor II mutation	
Pregnancy or post-partum	Prolonged bed rest (>72 h)	Lupus-type circulating anticoagulant	
Unexplained spontaneous miscarriage	Plaster cast	Anti-cardiolipin antibody	
Oral contraceptive	Central venous line	Hyperhomocysteinemia	
Sepsis (<1 month)		Heparin-induced thrombocytopenia	
Acute respiratory disease (<1 month)		Congenital or acquired thrombophilia	
Chronic respiratory failure			
Myocardial infarction			
Heart failure (<1 month)			
Inflammatory bowel disease			
Acute medical condition			

Total score: 0–1, low risk; 2, moderate; 3–4, high; 5, very high.

respiratory failure, hormone therapy, oral contraception, stroke with neurological deficit, post-partum status, age, obesity, and prolonged bed rest [3]. Furthermore, a multicenter cohort study of 1,432,855 patients showed that VTE risk increased with duration of surgery [6]. Prevention must be emphasized in this population at increased risk.

Immobilization has been described as a major risk factor for VTE, especially in elderly populations over 70 years of age [7]. Any prolonged bed rest may be complicated by muscle wasting, skeletal demineralization, joint stiffness, metabolic disorders, thromboembolism, cardiovascular decompensation with orthostatic hypotension and effort dyspnea, pulmonary complications, bed sores, peripheral nerve compression, and depression [8]. It is therefore essential to encourage early ambulation and to mobilize

patients as quickly as possible, often within tens of minutes after returning to their room [9]. Early mobilization, within 24 h, is an essential component of ERP as well as a prognostic factor [10] and it is strongly recommended [11] as part of a multidisciplinary approach that involves anesthesiologist, surgeon, physiotherapist and the nursing team. Besides its positive impact on the resumption of gastrointestinal transit and tolerance of feeding, it reduces the incidence of post-operative thrombo-embolic and medical complications [12]. In the MEDENOX study [13], Amin et al. have shown that an active ambulatory status reduces the risk of VTE significantly, especially when it is associated with thromboprophylaxis using Enoxaparin 4000 IU/day [14].

The choice of thromboprophylactic measures is a critical element in the prevention of VTE. They can be mechanical as well as pharmacological and both types are often combined in the high-risk patient. The dose and administration time of anticoagulants must be well known to minimize both the risk of thrombosis and also of hemorrhage. Elastic compression stockings help to compensate for the loss of “pumping function” in the calf and plantar arch of patients at bed rest. To be effective, calf compression must be in place two hours before the start of the intervention and then continued throughout the post-operative period until resumption of active ambulation. Although widely used, there is no high level evidence in the literature regarding calf compression stockings and their use does not replace pharmacological prophylaxis in patients at high risk of thrombosis. Indeed, the CLOTS 1 study [15] of 2518 patients admitted for acute stroke who were randomized into two groups, with or without elastic support stockings, did not show a decrease in the incidence of VTE. Moreover, they can be associated with some side effects such as skin ulceration and are formally contra-indicated in patients with severe arterial disease [16]. In practice, at least Class 2 stockings, which correspond to 15–20 mmHg compressive pressure, should be used preventively.

Table 2 Patient-related risk factors for thrombosis.

Immobility, bed rest, limb paralysis
Cancer and cancer treatment (hormonal, chemotherapy, or radiotherapy)
Past history of venous thrombo-embolic events
Age > 40 years
Estrogen-containing oral contraceptives or hormone replacement therapy
Estrogen receptor modulating medications
Acute medical condition
Heart failure, respiratory failure
Inflammatory bowel disease
Nephrotic syndrome
Myeloproliferative disease
Paroxysmal nocturnal hemoglobinemia
Obesity (BMI > 30)
Smoking
Varicose veins
Central venous catheter
Congenital or acquired thrombophilia

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