Risk factors associated with development of Deep Venous Thrombosis in the postoperative period

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List of Abbreviations

ACCP – American College of Chest Physicians.

ADP – Adenosine Diphosphate.

APC – Activated Protein C.

APCR – Activated Protein C Resistance.

CDT – Catheter Directed Thrombolysis.

CRP – C-Reactive Protein.

CTA – Computed Tomography Angiography.

DUS – Duplex Ultrasound.

DVT – Deep Venous Thrombosis.

ET – Essential Thrombocythemia.

ETP – Endogenous Thrombin Potential.

FDA – US Food and Drug Administration.

FM – Fibrin Monomer.

HMWK – High Molecular Weight Kininogen.

HRT – Hormone Replacement Therapy.

IL – Interleukin.

IPC – Intermittent Pneumatic Compression.

IUA – International Union of Angiology.

IVC – Inferior Vena Cava.

LDUH – Low Dose Unfractionated Heparin.

LMWH – Low Molecular Weight Heparin.

MI – Myocardial Infarction.

MRV – Magnetic Resonance Venography.

NICE - National Institute of Clinical Excellence.

PAF – Platelet Activating Factor.

PCD – Phlegmasia Cerulea Dolens.

PE – Pulmonary Embolism.

PGI_2 – Prostacyclin.

PLA_2 – Phospholipase A_2.

QTL – Quantitative Trait Locus.

TF – Tissue Factor.

TFPI – Tissue Factor Pathway Inhibitor.

TG – Thrombin Generation.

tPA – tissue Plasminogen Activator.

TXA_2 – Thromboxane A_2.

UFH - Unfractionated Heparin.

VKAs – Vitamin K Antagonists.

VKORC – Vitamin K Epoxide Reductase.

VTE – Venous Thromboembolism.

vWF – von Willebrand Factor.

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Introduction

A venous thrombosis is a blood clot (thrombus) that forms within a vein. A classical venous thrombosis is deep vein thrombosis (DVT), which can break off (embolize), and become a life-threatening pulmonary embolism (PE). The disease process venous thromboembolism (abbreviated as VTE or DVT/PE) can refer to DVT and/or PE.

To reduce VTE incidence, persons at risk for venous thromboembolism must first be identified. Independent risk factors for VTE include increasing patient age, surgery, trauma, hospital or nursing home confinement, active cancer with or without concurrent chemotherapy, central vein catheterization or transvenous pacemaker, prior superficial vein thrombosis, varicose veins and neurological disease with leg paresis; patients with chronic liver disease have a reduced risk ***(Heit et al., 2000).***

The incidence of VTE increases significantly with age for both idiopathic and secondary VTE, suggesting that the risk associated with advancing age may be attributable to the biology of aging rather than simply an increased exposure to VTE risk factors with advancing age ***(Kobbervig et al., 2004).***

Generally, hospitalized patients have more than a 100-fold increased incidence of acute VTE, where together hospitalization and nursing home residence account for almost 60% of incident VTE events occurring in the community. Nursing home residence independently accounts for more than one tenth of all VTE disease in the community ***(Heit et al., 2004).***

Of note, hospitalization for medical illness and hospitalization for surgery account for almost equal proportions of VTE (22% and 24% respectively), emphasizing the need to provide prophylaxis to both of these risk groups ***(Heit et al., 2004).***

Active cancer accounts for almost 20% of incident VTE events occurring in the community. The risk appears to be higher for patients with pancreatic cancer, lymphoma, malignant brain tumors, liver cancer, leukemia, colorectal and other digestive cancers. Cancer patients receiving immunosuppressive or cytotoxic chemotherapy are even at higher risk for VTE ***(Geerts, et al., 2004).***

The risk among surgery patients can be further stratified based on patient age, type of surgery, and the presence of active cancer. The incidence of postoperative VTE is increased with advancing patient's age ***(White et al., 2003).***

High risk surgical procedures include neurosurgery, major orthopedic surgery of the leg, thoracic, abdominal or pelvic surgery for malignancy, renal transplantation and cardiovascular surgery. After controlling for the type of surgery and active cancer, additional independent risk factors for VTE within 3 months after major surgery include increasing body mass index, intensive care unit admission for six days or longer, central venous catheter, prolonged immobility, varicose veins and infection ***(Heit, 2005).***

Medical conditions associated with VTE include heparin induced thrombocytopenia, myeloproliferative disorders (especially polycythemia rubra vera and essential thrombocytosis), intravascular coagulation and fibrinolysis, disseminated intravascular coagulation, nephrotic syndrome, paroxysmal nocturnal haemoglobinuria, thromboangitis obliterans (Buerger's disease), thrombotic thrombocytopenic purpura, Behcet syndrome, systemic lupus erythematosus, inflammatory bowel disease, homocystinuria and possibly hyperhomocysteinemia ***(Key and McGlennen, 2002).***

Among women, additional risk factors for VTE include hormone therapy, oral contraceptive use (especially 1st and 3rd generation), pregnancy, post-partum period and therapy with selective estrogen receptor modulator, raloxifene ***(Heit, 2005).***

Hormone therapy is associated with a 2- to 4- fold increased risk of VTE, but the risk may vary by type of estrogen. The overall incidence of pregnancy associated VTE is about 200 per 100,000 woman-years; compared to non pregnant women of childbearing age, the relative risk is increased about 4-fold. The risk during postpartum period is about 5-fold higher than the risk during pregnancy ***(Smith et al., 2004).***

Independently, air travel (more than 6 hours) is associated with slightly increased risk for VTE that is preventable with graduated compression stockings ***(Dalen, 2003).***

New evidence-based guidelines from the American College of Chest Physicians (ACCP) address the many risk factors for developing a deep vein thrombosis (DVT), or blood clot, as the result of long-distance travel. Also suggests there is no definitive evidence to support that travelling in economy class can lead to the development of a DVT, therefore, dispelling the myth of the so-called “economy class syndrome” ***(Northbrook, 2012).***

Travelling in economy class does not increase risk for developing a blood clot, even during long-distance travel; however, remaining immobile for long periods of time will. Long-distance travelers sitting in a window seat tend to have limited mobility, which increases their risk for DVT. This risk increases as other factors are present ***(Mark, 2012).***

Aim of Work

Determination of the risk factors associated with the development of Deep venous thrombosis in the post operative period and the impact of type and duration of surgery and type of anesthesia on occurrence of post operative DVT.

Anatomy of Venous System of the Lower Limb

Venous system of lower limb is divided into three groups:

- Superficial system, which lies outside the deep fascia.
- Deep system, which lies within the deep fascia.
- Perforating system, which pass through the deep fascia and connect the deep and superficial system.

The venous channels in the lower limb contain valves which facilitate flow in a centripetal in the axial vessels and from superficial system to the deep system via perforating veins ***(Michael, 2002)***.

The Superficial Venous System

The superficial system consists of network of venules and veins in the skin and subcutaneous tissues that empty into both deep chamber and the pump outflow tract. The two main superficial veins, the long and the short saphenous veins, drain directly into the outflow tract, but there are many other connections between the superficial veins and the veins of the deep compartment. The superficial tributaries of the saphenous

system collect blood from the two main veins. The saphenous veins themselves lie in a deeper layer of the subcutaneous tissues underneath a thin but quite strong layer of connective tissue. The valves ensure that blood flows into pump and towards the heart. Blood leaves the superficial compartment by flowing up the saphenous veins into the femoral or popliteal veins or directly into the pump through the many communicating veins ***(Norman et al., 2003).***

Superficial Veins of foot

The superficial veins of the plantar surface of the foot are small, and join to form a plantar venous network. This receives distally the superficial veins from the plantar surface of the toes and drains into the dorsal venous system by numerous small channel that pass around the venous network also communicates with the deep veins of the plantar surface through slender vessels that run vertically upward along the intermuscular septa of the foot ***(Henry and Hollinshear 2004).***

On the dorsum, the dorsal digital veins are joined by veins from the plantar surface to form four dorsal metatarsal veins that unite to form a dorsal venous arch at about the level of the heads of the metatarsals. The medial end of dorsal venous arch receives vessels from the medial side of the plantar surface of the foot and