



Primary Thromboprophylaxis Among Surgical Patients in a Sub-Saharan Tertiary Health Institution

Mbah N*

Department of Surgery, Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH), Nigeria

Abstract

Background: Venous thromboprophylaxis aims at reducing avoidable morbidity, death and chronic ill health from hospital-associated Venous Thromboembolism (VTE). Reports indicate inadequate provision of primary thromboprophylaxis on surgical patients managed in most hospitals across Africa.

Aim: To determine the level of Venous Thromboembolism (VTE) risk among adult surgical patients seen at the Chukwuemeka Odumegwu Ojukwu Teaching Hospital (COOUTH) Awka, Nigeria, evaluate the proportion of these patients who receive venous thromboprophylaxis and offer recommendations to optimize patients' outcome.

Methods: The Caprini model of VTE risk assessment was used prospectively to evaluate consecutive patients admitted into the adult surgical services of the COOUTH, Awka, Nigeria over a three month period (June 2023–August 2023).

Results: Two hundred and forty-nine adult surgical patients were studied among whom 208 patients (83.5%) had a Caprini score of ≥ 3 indicating moderate risk or more for VTE. The males were 123/208, females 85/208; M:F ratio 1.4:1. The age range of the study population was 18 to 92 years, mean 51 years. Overall, only 59/208 (28.4%) patients at significant VTE risk received primary thromboprophylaxis. The medications used were enoxaparin (26/59 patients, 44.1%), dabigatran (21/59, 35.6%), clopidogrel (8/59 patients, 13.6%) and rivaroxaban in 4 (6.8%). None of the subjects received anti-embolism stockings or intermittent pneumatic compressions.

Conclusion: A large number (84%) of adult patients hospitalized within the surgical services of the COOUTH are moderate to high risk for VTE. Standard primary thromboprophylaxis practice for these cases is low (28%). The routine use of hospital-based VTE risk assessment model and the provision of primary VTE prevention for the large number of patients at significant risk need to be strongly enforced in order to optimize patients' outcome.

Keywords: Thromboprophylaxis; Venous thromboembolism; Risk Factors; Clinical Practice Guideline

Introduction

Venous Thromboembolism (VTE) is preventable. According to the United States Agency for Healthcare Research and Quality (AHRQ), the prevention of VTE is the number one strategy to improve patient care [1]. Clinically, the practice of primary venous thromboprophylaxis, which are measures taken to prevent venous thrombosis, is directed at both Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE) but not superficial thrombophlebitis which is a less severe form of blood clot formation within the superficial veins.

International guidelines recommend that patients are assessed upon admission for any risk of VTE and bleeding tendencies. The protocol also provides guidance on who should receive pharmacological prophylaxis, mechanical prevention, or both, or none [2-5]. In general, strong patient safety agenda has led surgeons internationally to agree on a low threshold for using mechanical and pharmacological methods of prophylaxis unless there is a good reason not to do so. The appropriate standard pre-operative, intra-operative and postoperative thromboprophylaxis practice should be instituted in every hospital as a healthcare policy for eligible patients who are at moderate or high risk of VTE [6-9].

Conversely, routine prophylaxis in low-risk patients probably does not justify the costs and risks of anticoagulation [10].

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*Correspondence:

Mbah N, Department of Surgery,
Chukwuemeka Odumegwu Ojukwu
University Teaching Hospital
(COOUTH), Awka, Anambra State,
Nigeria, Tel: +2347016204276

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Table 1: Caprini Score Calculator (Risk Factors and Corresponding Points).

Each Risk Factor Represents 1 Point	Each Risk Factor Represents 2 Points
• Age 41–60 years	• Age 60–74 years
• Minor Surgery Planned	• Laparoscopic Surgery (> 45 minutes)
• History of Prior Major Surgery (<1 Month)	• Arthroscopic Surgery
• Varicose Veins	• Malignancy (Present or Previous)
• History of Inflammatory Bowel Disease	• Major Surgery (>45 minutes)
• Swollen Legs (Current)	• Patient confined to bed (>72 hours)
• Obesity (BMI >25 kg/m ²)	• Immobilizing Plaster Cast (<1 month)
• Acute Myocardial Infarction	• Central Venous Access
• Congestive Heart Failure (<1 Month)	
• Sepsis (<1 Month)	
• Serious Lung Disease Including Pneumonia (<1 Month)	
• Abnormal Pulmonary Function (COPD)	
• Medical patient currently at bed rest	
• Other Risk Factors	
Each risk factor represents 3 points	Each risk factor represents 5 points
• Age >75 years	• Elective major lower extremity arthroplasty
• History of DVT/PE	• Hip, Pelvis or Leg Fracture (< 1 Month)
• Family History of Thrombosis	• Stroke (< 1 Month)
• Positive Factor V Leiden	• Multiple Trauma (<1 Month)
• Positive Prothrombin 20210A	• Acute spinal cord injury/paralysis (<1 Month)
• Elevated Serum Homocysteine	
• Positive Lupus Anticoagulant	
• Elevated Anticardiolipin Antibodies	
• Heparin Induced Thrombocytopenia (HIT)	
• Other Congenital or Acquired Thrombophilia If Yes, Type	For women only: Each factor represents 1 point
	• Oral contraceptives or hormone replacement therapy
	• Pregnancy or Postpartum (<1 month)
	• History of unexplained still birth infant (<1 month)
	• Recurrent spontaneous abortions (≥ 3)
	• Premature birth with toxemia or growth-restricted infant
	TOTAL RISK FACTOR SCORE =

In high income nations, primary thromboprophylaxis practice is routine for most hospitalized surgical patients who do not have identifiable contraindications for prevention. By contrast, available reports indicate inadequate VTE prophylaxis among surgical patients managed in most hospitals across Africa and other developing regions of the world [11-15]. Consequently, this study was designed to determine the level of Venous Thromboembolism (VTE) risk among adult surgical patients admitted into a sub-Saharan tertiary health facility, evaluate the proportion of these patients who receive primary venous thromboprophylaxis and offer recommendations which if implemented would optimize patients’ outcome.

Materials and Methods

We prospectively used the Caprini risk assessment model to evaluate all adult patients aged 18 years and older who were admitted into the surgical services of the Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Awka, Nigeria from June to August

2023. The VTE risk factors and their respective corresponding points using the Caprini score calculator are listed in Table 1. The interpretation of the total score and the universally recommended clinical actions are provided in Table 2. The presentation of the result is done with group percentages, relative frequency distribution, tables, charts and simple statistical methods.

Study setting: The Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH) is the only tertiary health institution in Awka, the capital city of Anambra state, Nigeria. It is affiliated to the university that bears the same name. COOUTH serves approximately 9,000 adult surgical patients per annum who are drawn from different parts of Anambra State and the neighboring states in the south-East and south-South geopolitical regions of the country.

Exclusion criteria: Patients with pre-established DVT or PE upon admission for which they were receiving therapeutic anticoagulation, as well as surgical patients below 18 years of age were excluded from

this survey.

Data collection and analysis: A printed data collection form was used to obtain the relevant information directly from the eligible patients and indirectly from their respective case notes. Patients biodata, date of hospital admission, history of VTE risk factors, Body Mass Index (BMI) calculated from patient’s weight and height, clinical diagnosis, operation planned or performed, managing surgical specialty, presence of thromboprophylaxis prescription, limb swelling, plaster cast, diabetes mellitus, varicose veins, congestive heart failure, bleeding disorder, any actively bleeding condition, uncontrolled hypertension, cardiovascular accident (stroke), chest infection, malignancy, use of steroidal therapy or hormonal medications such as oral contraceptive pills were documented. A past history of VTE in the patient, as well as family history of DVT and PE were also recorded. The Caprini score calculator was used to calculate the VTE risk score (Table 1).

Ethical considerations: Ethical clearance was obtained from the Ethical Committee of the Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH hospital beforehand. The study population was not placed at additional risk because there was no interference with patient care as the study was observational only.

Results

Two hundred and forty-nine adult surgical patients were studied of whom 208 patients (83.5%) had a Caprini score of ≥ 3 indicating moderate risk and above for VTE (Table 3 and Figure 1). The males were 123/208, females 85/208; M:F ratio 1.4:1. The age range of the study population was 18 to 92 years, mean 51 years. The 5 commonest predisposing risk factors were age above 40 years 145/208 (69.7%), elective minor surgery or duration of major surgery beyond 45 min 143/208 (68.8%), BMI greater than 25 kg/m² in 83/208 (39.9%), leg oedema 71/208 (34.1%) and immobilization on the bed of more than 72 h duration in 51/208 (24.5%), Table 3 and Figure 1.

Overall, 59/208 (28.4%) patients at significant VTE risk received primary thromboprophylaxis. The medications dispensed were enoxaparin (26/59 patients, 44.1%), dabigatran (21/59, 35.6%), clopidogrel (8/59, 13.6%) and rivaroxaban in 4/59 (6.8%), Figure 2. None of the subjects received anti-embolism stockings or intermittent pneumatic calf compression (Figure 3).

Discussion

Our study highlights a high prevalence of Venous Thromboembolism (VTE) risk factors among the surgical patients managed at our center. Well over 80% of our surgical cases had moderate or high-risk profile for thromboembolism. Another report from Nigeria showed that 100% of the surgical patients studied had a Caprini score of ≥ 3 indicating moderate risk and above for VTE [16]. The difference between the latter study and ours was they surveyed only postoperative patients whereas we enrolled both the non-operated and operated surgical patients in our series. The finding

Table 3: Specific VTE risk factors, Caprini points and frequencies.

Risk Factors	Point	Male	Female	Total
Age 41-60 years	1	54	27	81 (38.9%)
&	+	+	+	+
Age 61-75 years	2	30	26	56 (26.9%)
&		+	+	+
Age >75 years	3	3	5	8 (3.8%)
TOTAL	-----	87	58	145 (69.6%)
Major Surgery (General Surgery >45 mins	2	71	36	107 (51.4%)
&		+	+	+
Minor Surgery Planned	1	26	10	36 (17.3%)
TOTAL	-----	97	46	143 (68.7%)
BMI ≥ 25 kg/m ²	1	41	42	83 (39.9%)
Leg Oedema	1	50	21	71 (34.1%)
Immobility >72 hrs	2	26	25	51 (24.5%)
Multiple Trauma	5	41	5	46 (22.1%)
Respiratory Tract Infection	1	26	20	46 (22.1%)
Cancer	2	21	15	36 (17.3%)
Leg Fractures/Hip Fractures	5	21	15	36 (17.3%)
Varicose Veins	1	31	5	36 (17.6%)
Spinal Cord Fractures	5	10	5	15 (7.2%)
Arthroplasty of Lower Limb	5	1	9	10 (4.8%)
Hormonal Therapy	1	5	5	10 (4.8%)
Postpartum	1	-	5	5 (2.4%)

of significant VTE risk factors among the greater majority of surgical patients in our environment should therefore prompt the robust use of primary VTE prophylaxis in our routine surgical practice.

The dominant predisposing risk factor from our center was age above 40 years. Others were elective minor or major surgery, high body mass index >25 kg/m², leg oedema and immobility of more than 3 days in the descending order of frequency. These findings are in consonance with observations elsewhere, thereby supporting the notion of the universality of VTE risk among surgical patients in particular, and hospitalized patients in general [14,15,17,18]. However, there are some observed differences in the order pattern from the different reports. Undergoing a major surgical procedure was the commonest risk factor in the study by Tadesse et al., whereas immobility of more than 3 days dominated the series from Singapore [15,18]. Although both studies also used the Caprini risk assessment model for the risk stratification of their surgical subjects as we did, they differed from ours in several respects. The former was a retrospective survey while both studies were conducted on only postoperative surgical patients. These differences could explain the variance in the prevalence of the commonest VTE risk markers recorded. Moreover, the study populations are different from each other.

Table 2: Interpretation of Caprini score and clinical recommendation.

Total Risk Score	Risk Category	Recommendation
0-1	Very Low Risk For VTE	General Measures (Adequate hydration & Frequent Ambulation)
2	Low Risk For VTE	General Measures + *GECS
3-4	Moderate Risk For VTE	GECS + Pharmacological Prophylaxis
≥ 5	High Risk For VTE	GECS + Pharmacological Prophylaxis + Intra-operative **IPCD

*GECS: Graduated Elastic Compression Stockings; **IPCD: Intermittent Positive Calf Compression Device

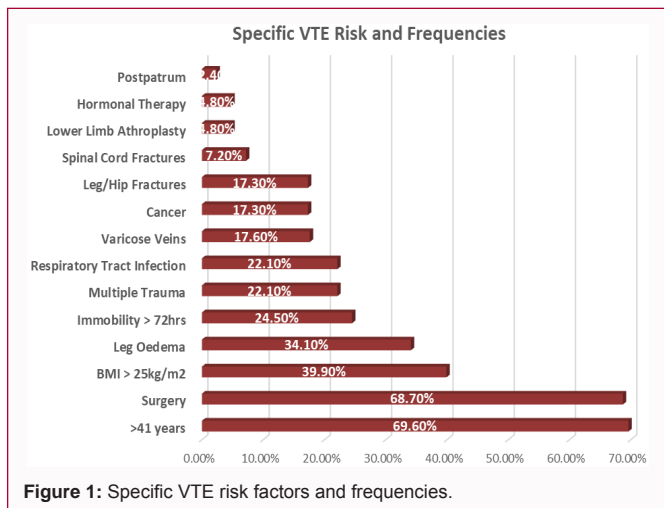


Figure 1: Specific VTE risk factors and frequencies.

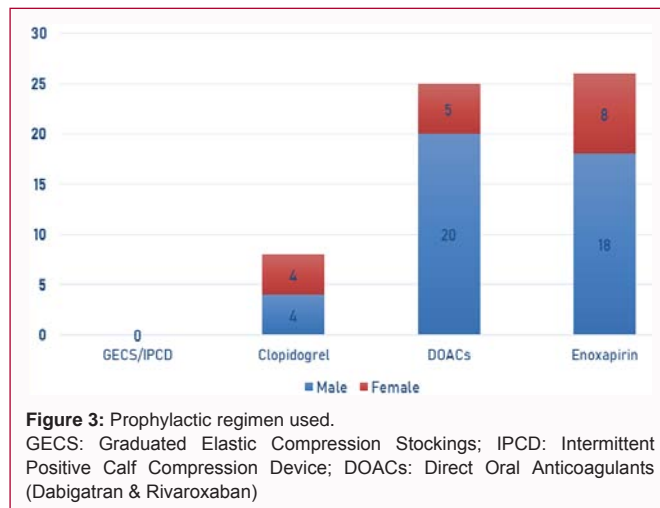


Figure 3: Prophylactic regimen used. GECS: Graduated Elastic Compression Stockings; IPCD: Intermittent Positive Calf Compression Device; DOACs: Direct Oral Anticoagulants (Dabigatran & Rivaroxaban)

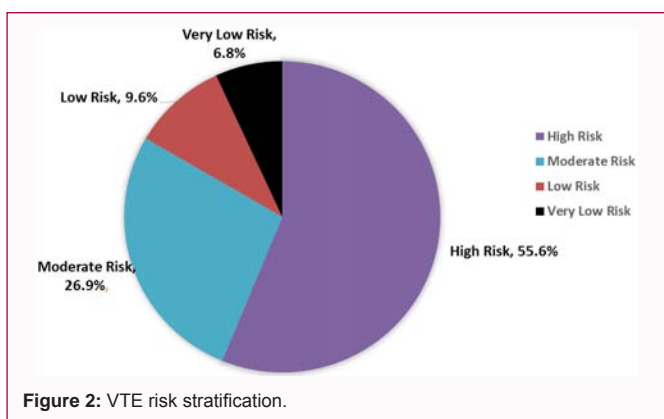


Figure 2: VTE risk stratification.

Venous Thromboembolism (VTE) is familiar to surgeons worldwide. A recent audit showed that 83.5% of surgeons across Nigeria encountered PE in their practice while a vast majority (90.5%) of these clinicians had come across patients with DVT [19]. Yet the knowledge and practice of prophylactic anticoagulation remain suboptimal regardless. Only 33% of Nigerian surgeons had adequate knowledge of DVT prevention whereas a smaller 20% minority practiced routine VTE prophylaxis [19]. Similar deficiency in the knowledge and practice of VTE prevention among surgeons and health care providers practicing in other developing nations were observed by Bhatti et al. and Kimmerly et al. [20,21].

Less than a third (28.4%) of eligible surgical patients in our center received VTE prophylaxis. This is higher than the 3.2% recorded from Pakistan, 17.8% from Addis Ababa, 19.4% from Ile-Ife, 25% from Dar es Salaam, and 26% from Jordan [14,15,22-24]. These values confirm the underutilization of VTE prevention in many developing countries among surgeons despite the availability of effective and safe prophylactic measures. This low rate of VTE prophylaxis is predicated upon several factors, notably the absence of a thromboprophylaxis policy in the local hospitals, the fear of post-operative hemorrhage, the perceived low incidence of VTE in low-income societies, the clinicians' lack of familiarity with VTE preventive measures and agents, their dosage and duration of administration [25,26].

By contrast, thromboprophylaxis practice and implementation are much higher in some other developing nations and in most high-income countries. Ninety-point eight percent (90.8%) of surgical patients received prophylactic anticoagulation in an Algerian report

indicating a better than average compliance [27]. Similarly, more than 80% used VTE prophylaxis in an Italian study whereas the compliance rates in two consecutive audits in a single UK hospital were 81% and 90% respectively among eligible surgical patients [28,29]. Such high compliance rates with prophylactic anticoagulation should be the goal of surgeons in regions like ours where this practice is still suboptimal.

The consequence of deficient VTE prophylaxis in high-risk surgical patients is dire. Without the appropriate anticoagulation, the reported incidence of both DVT and PE ranges from 10% to 40% [14]. About 10% of unexpected hospital death is attributable to PE annually in the United States, killing more people than AIDS, breast cancer and highway crash combined [1]. Other morbidities from VTE include recurrent thrombosis, pulmonary hypertension and post thrombotic syndrome which is associated with edema, venous ulcers and significantly decreased quality of life [30,31]. Therefore, controlling the various risk factors and the use of primary thromboprophylaxis would effectively reduce the chances of developing this disease and its complications.

Various national and international guidelines exist for the VTE risk assessment and stratification of surgical patients, their bleeding tendencies and measures of primary thromboprophylaxis to be recommended for each category of patients. Some of these tools are the Caprini score calculator or a modified version of it (Table 1), American College of Chest Physicians (ACCP) guidelines, the European Consensus (EC) guidelines, the Department of Health (DH) risk stratification model (UK), the National Institute for Health and Clinical Excellence (NICE) guidance and the American Society of Hematology (ASH) model [3-5,32,33]. As would be expected, each guideline differs somewhat from others in design and detail. Because it is categorical and relatively easy to estimate, the Caprini risk assessment model is widely used in hospitalized surgical patients both for individualized VTE risk assessment as well as for the recommendation of the preventive measures to be instituted for each risk category (Table 2) [14-16,32]. Patients with Caprini scores of 0 to 1 point have very low VTE risk. Therefore, early and frequent ambulation are advised. A score of 2 points indicates low VTE risk, for which mechanical prophylaxis with anti-embolism Graduated Elastic Compression Stockings (GECS) is recommended in the absence of contraindications. Exemption from the use of GECS include patients with overt leg ischemia [34]. Moderate VTE risk, with scores of 3 or 4 points, requires a combination of pharmacological and mechanical

measures for VTE prevention. For patients with the high VTE risk of 5 points and above, the administration of anticoagulants and GECS, supplemented by use of intraoperative Intermittent Pneumatic Calf Compression Device (IPCD) are recommended in the absence of contraindications [32].

Enoxaparin, a Low Molecular Weight Heparin (LMWH), was the anticoagulant most commonly prescribed for VTE prophylaxis in our series. Several other centers observed a similar prescription preference [14,19,23]. Ninety-two percent (92%) of cases reported from Dar es Salaam had enoxaparin for prevention of VTE [14]. The attributes which lend enoxaparin as the preferred medication for VTE prevention among surgical patients include the efficacy, the availability in the local market, the once daily dosage regimen, the subcutaneous route of administration postoperatively in patients who may be kept on nil by mouth, the lower risk of Heparin-Induced Thrombocytopenia (HIT), the high safety profile and it does not require monitoring at the standard recommended dose [11]. Other LMWH, such as dalteparin and tinzaparin, are effective alternatives. Different centers may prefer different LMWH for VTE thromboprophylaxis. Surgeons at the Royal Devon and Exeter hospital in the UK used dalteparin [29].

Other types of anticoagulants have been utilized elsewhere for the prevention of VTE in surgical patients. Indeed, the American College of Chest Physicians (ACCP) 2016 guidelines recommend Unfractionated Heparin (UFH) for general, vascular, gynecologic and urological surgery [35]. Although the greater majority (18/24, 75%) of patients received Unfractionated Heparin (UFH) at a center in Addis Ababa, none of our patients used this medication which reflects differences in surgeons' preference [15].

An equally high proportion of our cases (42%) received the Direct Oral Anticoagulant (DOAC) agents for thromboprophylaxis, either as dabigatran or as rivaroxaban. Being tablet medications, these agents are prescribed for surgical patients who are allowed oral intake. Direct oral anticoagulants have quickly become attractive alternatives to warfarin, a Vitamin K Antagonist (VKA), which had been the older long-standing standard of care in anticoagulation [36]. Although warfarin is relatively cheaper, the numerous superior advantages of DOACs include their convenient fixed dosage regimen, they do not require regular International Normalized Ratio (INR) monitoring, they have rapid onset and offset of action as they are cleared quicker from the system if the medication needs to be stopped for a surgical procedure, they possess lower risk of bleeding, they have fewer food and drug interactions and therefore offer consistent efficacy [37,38]. DOACs are widely used by the orthopedic surgeons in clinical practice more than any other surgical specialty [39-42]. This also reflects the practice trend in our surgical services, as all those who received DOACs in our center were orthopedic patients. Incidentally, the DOACs are more expensive and therefore may not have high patient compliance in all public hospital settings in sub-Saharan Africa. In Kenya, a tablet of DOAC agent is priced over forty times more than a tablet of warfarin [43]. Consequently, the use of DOACs became limited to the private sector hospitals in that nation.

The oral antiplatelet anticoagulant, clopidogrel, was prescribed for VTE prevention in a minority (13.6%) of our cases. Most published series do not use clopidogrel for routine prophylaxis in hospitalized surgical patients. Clopidogrel despite being an effective agent for VTE prevention could present a dilemma when used for prophylaxis in the surgical patient. It takes several days after discontinuing clopidogrel

before a surgical procedure could safely take place on the patient if excessive bleeding is to be avoided. Based on the manufacturer's recommendation, clopidogrel should be stopped seven days preoperatively to allow the physiologic antiplatelet effects wear off [44]. This property renders clopidogrel less useful for routine primary thromboprophylaxis in hospitalized surgical patients who may be required to undergo a surgical procedure with minimum delay. The absence of a local hospital policy on VTE prophylaxis in our center led to the lack of consensus and uniformity in the prescription pattern of antithrombotic agents for the eligible surgical patients.

Thromboprophylaxis using mechanical methods, which include GECS and IPCD, promote the emptying of blood from venous valve pockets and increase venous outflow from the legs. Consequently, they provide a means of reducing morbidity and mortality from VTE. Therefore, in the absence of inimical lesions in the leg, they may be preferred to anticoagulants for those moderate and high VTE risk surgical patients who are at significant risk of major bleeding [34]. Otherwise, in the absence of contraindications to anticoagulant use for high VTE risk surgical patients, both mechanical prevention and pharmacological prophylaxis may be combined to increase the efficiency of prophylaxis [45,46]. Unlike the practice in Europe, North America and elsewhere, the use of Graduated Elastic Compression Stockings (GECS) or Intermittent Pneumatic Calf Compression Devices (IPCD) are not popular in several developing nations [47-49]. None of our patients received either form of mechanical prevention (Figure 3). This deficiency in practice is shared across other centers in Dar es Salaam (Tanzania) and Addis Ababa (Ethiopia) respectively [14,15]. Only 3.6% surgical patients received GECS for VTE prevention at Ile-Ife, Nigeria, but none had IPCD. The scarcity, cost, warmer weather in Africa, and in few cases the lack of familiarity with these mechanical methods of VTE prevention among healthcare providers possibly underlie their underutilization in the tropics.

In conclusion, majority of our surgical patients are moderate and high risk for VTE. Primary thromboprophylaxis for these patients is suboptimal despite the availability of effective antithrombotic agents. The formulation and implementation of hospital policy at both the local and national levels for routine VTE risk assessment and prevention in eligible surgical patients will optimize clinical outcome.

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