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Venous thromboembolism prophylaxis in patients hospitalized in medical wards
A real life experience

Keren Mahlab-Guri, MD[a,b]*, Monged Shaher Otman, MD[a,b], Natalia Replianski, MD[a,b], Shira Rosenberg-Bezalel, MD[a,b], Irina Rabinovich, MD[a,b], Zev Sthoeger, MD[a,b],*

Abstract

Venous thromboembolism (VTE) is a preventable cause of morbidity and mortality in acutely ill patients hospitalized in medical departments. Thromboprophylaxis with anticoagulants was shown to be safe and effective in medical patients with high risk to develop VTE. Despite guidelines recommendations, the rate of thromboprophylaxis in those patients is low. The objective of the study was to evaluate the rate of VTE risk assessment in routine medical department practice, the rate of eligible patients for thromboprophylaxis, the rate of patients who received thromboprophylaxis, and their outcome.

Medical records of consecutive patients (3000 at 2013, 1000 at 2018) hospitalized in medical department were reviewed, retrospectively, for demographic, clinical characteristics, thromboprophylaxis treatment with enoxaparin and outcome (up to 90 days following discharge). Padua score was used for VTE risk assessment. VTE diagnosis was based on clinical suspicion.

The mean patient's age (52.6% females) was 67.95 ± 21.56 years. 21% were eligible for thromboprophylaxis. Routine VTE risk assessment rate increased significantly following its incorporation into quality parameters, but the rate of treated patients was low (22% at 2013; 46% at 2018). The patients who received thromophylaxis were sicker compared to eligible patients without thromboprophylaxis. The rate of symptomatic VTE was low (0.24%; 0.12% and 0.55% for low and high VTE risk, respectively). Thromboprophylaxis did not have significant effect on the low number of VTE events. No major bleeding was observed.

Major efforts are still needed to increase the rate of thromboprophylaxis in all eligible medical patients according to the guidelines recommendations.

Abbreviations: DVT = deep venous thrombosis, HIT = heparin-induced thrombocytopenia, PE = pulmonary embolism, RAM = risk assessment model, VTE = venous thromboembolism.

Keywords: venous thromboembolism, medical patients, prevention, enoxaparin

1. Introduction

Venous thromboembolism (VTE), defined as deep venous thrombosis (DVT) or pulmonary embolism (PE), is associated with a significant disease burden in medical patients.[1] According to various studies, up to 42% of the medical hospitalized patients face a moderate or high risk to develop VTE[1] and as many as 10% to 20% of those patients are expected to develop VTE during their hospitalization.[2] Autopsy data suggest that VTE contributes to more than 10% of deaths of medical hospitalized patients.[3] In many of those cases, the patients were not diagnosed with VTE prior to their death. Moreover, about two-thirds of the patients who die from VTE were hospitalized in medical wards.[4] Thus, VTE is a frequent life-threatening disease in patients hospitalized in medical departments, but the rate of its diagnosis, treatment, and prevention in medical wards is quite low.[2]

Prophylactic treatments with anticoagulant agents such as enoxaparin are effective and can prevent VTE.[5] Indeed, a decline in the rate of VTE was observed in surgical[6] and orthopedics[7] wards, due to the implementation of prevention programs, whereas no such decline was observed in medical wards.[6] Therefore, it is important to raise the awareness of VTE risk and to implement effective prevention programs in medical wards.

To identify patients who are at increased risk for VTE, risk factors should be defined. Different studies identified many risk factors: such as acute illness,[8] older age,[9] obesity,[10] former VTE events,[11] genetic factors that are associated with increased risk of VTE (such as protein C, S deficiency, factor V Leiden, high fibrinogen levels),[1] acquired diseases (such as antiphospholipid syndrome),[12] stasis and immobilization,[11] malignancy,[13] varicose veins,[13] usage of estrogens,[14] and renal failure.[15]

Most guidelines recommend VTE prevention by subcutaneous injection, once daily, of enoxaparin (40 mg). This dosage was found to prevent VTE without causing serious bleeding complications.[16] In patients with renal failure (estimated

glomerular filtration rate 30–60 mL/h), the dose should be reduced to 20 mg once daily.[17] Currently, the recommended duration of VTE prevention treatment is short (during hospitalization), though a recent study reported the efficiency and safety of longer (28 days) treatment with enoxaparin 40 mg once daily compared to 10 days treatment.[18]

According to the 9th edition of the American College of Chest Physicians (ACCP 9) Evidence-Based Clinical Practice Guidelines, VTE prevention is recommended for high-risk patients hospitalized in medical wards (Grade 1B).[19] Thus, VTE prevention should be an integral part of the treatment (standard of care) of all hospitalized patients in medical wards with high risk to develop VTE, who do not have any contraindications for such treatment. To give VTE preventive treatment at the time of admission, there is a need for a simple way of evaluation of both, risk factors for VTE, and the contraindications for anticoagulant treatment. Barbar et al[20] suggested the Padua prediction score for VTE risk stratification (score of 4 points or more without contraindication is an indication for VTE prophylaxis). Despite rigorous randomized trials generating strong recommendations, many (up to 40%) of medical patients with an indication for VTE prevention do not receive appropriate preventive treatment.[21]

The objectives of the present study were to evaluate the actual rate of screening (Padua score determination) by the attending physicians in routine ("real life") practice, to determine the rate of medical ward patients who are at increased risk for VTE (Padua score ≥4) without contraindications for anticoagulant prophylaxis ("VTE eligible patients") treatment and to determine the rate of patients who did receive appropriate preventive treatment. Furthermore, we evaluated the 90 days outcome (the rate of VTE bleeding and mortality) of the eligible patients who received or did not receive appropriate thromboprophylaxis.

2. Patients and methods

2.1. Patients

The present study is a retrospective cohort study of 3000 consecutive patients who were admitted to medical wards in Kaplan Medical Center from the 1st of February to the end of July 2013. About 1000 other consecutive patients admitted to the same medical wards from the 1st of January to the end of March 2018 were also studied. Kaplan Medical Center is a university affiliated (Hebrew University, Jerusalem, Israel) secondary hospital, serving a population of about 400,000 people, mainly urban population. Patients who were admitted due to VTE, patients who were treated with low molecular heparin (e.g., enoxaparin, which is used in our hospital for prevention and treatment of VTE) for other indications (e.g., acute coronary syndrome, atrial fibrillation), patients who were chronically treated with other anticoagulant agents (such as warfarin and new oral anticoagulants), and patients under the age of 18 were excluded from the study. Patients who were treated with low dose aspirin (up to 100 mg/d) were included in the study, since high-risk (for VTE) patients with low-dose aspirin treatment should receive VTE prophylaxis with enoxaparin in addition to aspirin.

The VTE was diagnosed upon clinical basis. In all patients with suspected VTE, the diagnosis was confirmed by a compression ultrasound Doppler (for DVT) or by computed tomography (for PE). Screening compression ultrasound Doppler assays were not done in the present study. The study was approved by the Kaplan Medical Center ethic committee.

2.2. Data collection

All hospital medical ward records were reviewed for: age, sex, demographic, and clinical characteristics, the main reason for hospital admission, the presence of risk factors for VTE (defined by Padua score[20]), possible contraindications for anticoagulation treatment, VTE prevention treatment including the dosage, the duration of treatment and the clinical outcome (bleeding, new VTE, and mortality). For each participant patient, we determined whether the treating physicians calculated the Padua score at the time of hospitalization and then we calculated, retrospectively, the score for each participant. In the 1st part of the study (3000 patients evaluated in 2013), we also reviewed medical records (outpatient clinics and rehospitalization charts) of all participants within 3 months following their 1st hospital discharge. The outcome was assessed by mortality rate and the presence of VTE (either DVT or PE) as defined by compression US Doppler (DVT) or computed tomography (for PE).

2.3. Statistical analysis

Data are presented as mean ± standard deviation. Student t test was used to analyze continuous data. Fisher and Chi-squared tests were used to analyze categorical data. We used GraphPad software Prism 6 for windows (GraphPad Software, San Diego, CA) for statistical analysis. P-value ≤.05 was considered statistically significant.

3. Results

Our study included 3000 consecutive patients who were admitted to medical wards in Kaplan Medical Center, Rehovot, Israel, between February and July 2013. Additional 1000 consecutive patients were recruited between January and March 2018. The demographic characteristics of our 4000 patients are presented in Table 1. As can be seen in the table, the main causes for medical ward hospitalizations were cardiovascular disorders (27.7%) and infectious diseases (25.1%; mainly respiratory and urinary tract infections). About 7% of the patients had active malignant disease. However, malignancy was not the main cause for their current hospitalization.

During the 1st period of the study (2013), the rate of Padua score calculation by the treating physicians (as noted in the patient's medical records) was quite low (13%) (Fig. 1). Repeated lectures and instruction given by the head of the department during 2013 had no significant influence on the performing rate of Padua score assessment. At 2016, the performance of Padua score assessment, at the time of admission, was defined as a

Table 1

Demographics and clinical characteristics of the 4000 patients hospitalized in internal medicine department included in our study.

Number of patients	4000
Mean age ± standard deviation (range) in years	67.95 ± 21.56 (18–102)
Female	52.6%
Main cause of current hospitalization	Cardiovascular disease (27.7%)
	Infectious disease (25.1%)
	Neurologic disease (10.4%)
	Gastrointestinal disease (10.2%)
	Hematologic disease (5%)
	Endocrine disease (4.5%)
	Other diseases (17.1%)

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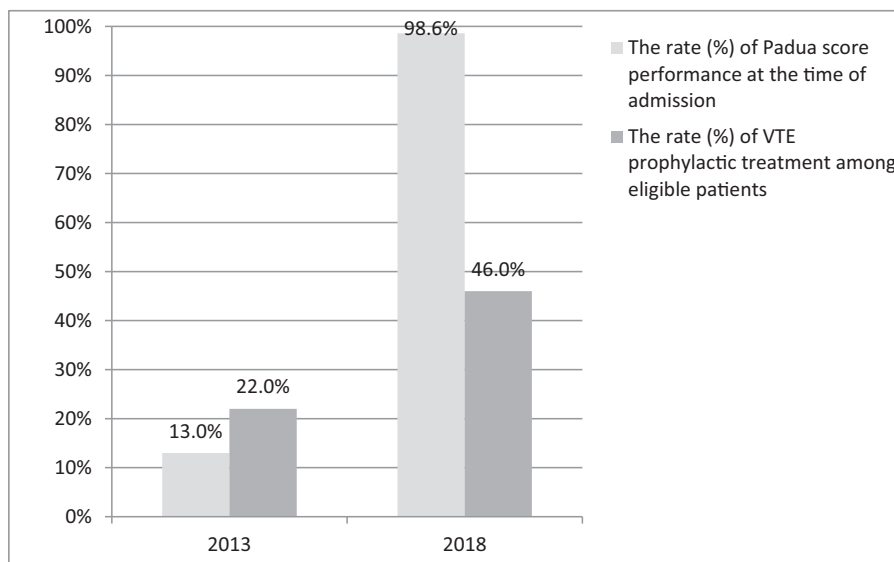
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Figure 1. The rate (%) of Padua score performance by the treating physicians at the time of admission to medical ward at the years 2013 and 2018 ($P = .0001$) and the rate (%) of venous thromboembolism prophylactic treatment among eligible patients (no new or chronic anticoagulant treatment, Padua score $\geq$4, no contraindication) at the years 2013 and 2018 ($P = .0005$).

national quality parameter for all medical departments in Israel. Therefore, we reevaluated the rate of Padua score assessment by the treating physicians at the year of 2018. Indeed, during January to March 2018, Padua score as defined routinely for almost all patients admitted to the same medical wards (98.6% of all medical admissions) (Fig. 1).

About 5th of the patients (583/3000; 19.4%) were excluded from the initial part of the study (2013): 124 patients due to chronic treatment with anticoagulant agents (mostly for atrial fibrillation) and other 459 patients due to new (at the time of admission) treatment with a full dosage of anticoagulants because of acute coronary syndrome, new onset atrial fibrillation or suspected PE/DVT. We defined, retrospectively, the Padua score for the remaining 2417 patients. The mean Padua score of those patients was 2.28 ± 2.04 (range: 0–11). As can be seen in Table 2, the main VTE risk factors (Padua scoring) were old age (>70; 50.8%), arthritis or infection (33.5%), and decreased mobility (27.3%). Active malignancy was observed in 7.43% of the patients. In 1689/2417 patients (69.9%), the Padua score was <4 points. Thus, they were not candidates for VTE prophylaxis. Nevertheless, 19 of those patients (0.78%) got VTE prophylaxis during their medical admission.

About 728 patients (30.1%) had a Padua score of 4 points or more (mean 5.02 ± 1.09; range 4–11 points). Thus, they had an indication for VTE prophylaxis. However, 110 of them had a contraindication for anticoagulant treatment (Fig. 2). Table 3 summarizes the main contraindications preventing the initiation of anticoagulant prophylactic treatment in those 110 patients. As can be seen in the table, the most common contraindications were thrombocytopenia (34.5%) and recent active bleeding (33.5%).

Six hundred and eighteen of our 3000 patients (20.6%) were eligible for VTE anticoagulant prophylaxis (no new or chronic anticoagulant treatment, Padua score 4, no contraindications). However, only 136 (22%) of them did receive VTE prophylaxis, whereas most (482; 78%) eligible patients did not get any VTE prophylaxis during their hospitalization (Fig. 2). The low rate of VTE prophylaxis was observed in all our patients regardless to their main cause of hospitalization. The mean Padua score was significantly higher among the patients who received VTE prophylaxis as compared to the eligible patients who did not get prophylaxis (5.36 ± 1.25 vs 4.94 ± 1.03; $P = .0001$ for the treated and untreated patients, respectively). Most treated patients received the recommended dose of enoxaparin (40 mg/d). Thirty-eight patients (27.9%) received a lower dose due to impaired renal function. The mean duration of VTE prophylaxis treatment was 8.36 ± 10.28 (range 1–49) days. In all patients, the VTE prophylactic treatment was stopped upon discharge from the medical wards.

Fifteen out of 136 patients (11%) patients who received VTE prophylaxis demonstrated bleeding complications. Twelve of them had minor gastrointestinal bleeding, 1 patient had bleeding around his tracheostomy, and 2 other patients had abdominal hematoma. Enoxaparin was discontinued immediately. However, none of the patients received blood, underwent surgical procedure or died from the bleeding. Heparin-induced thrombocytopenia (HIT) was not observed in our study.

Table 2

Risk factors for venous thromboembolism (VTE) in 2417 patients as defined by Padua score[20].

Risk factor (points in Padua score)	Number of patients (%)
Age, >70 (1)	1647 (54.9)[*]
Arthritis/active infection (1)	951 (31.7)
Decreased mobility (3)	831 (27.7)
Heart/respiratory failure (1)	562 (18.73)
Body mass index >30 (1)	387 (12.9)
Active cancer (3)	223 (7.43)
Ischemic stroke/myocardial infarction (1)	194 (6.46)
Past thromboembolic event (3)	56 (1.86)
Trauma/surgery at the last month (2)	28 (0.93)
Thrombophilia (3)	13 (0.43)
Hormonal replacement therapy (1)	2 (0.06)

[*] Several patients had more than 1 indication for VTE prophylaxis.

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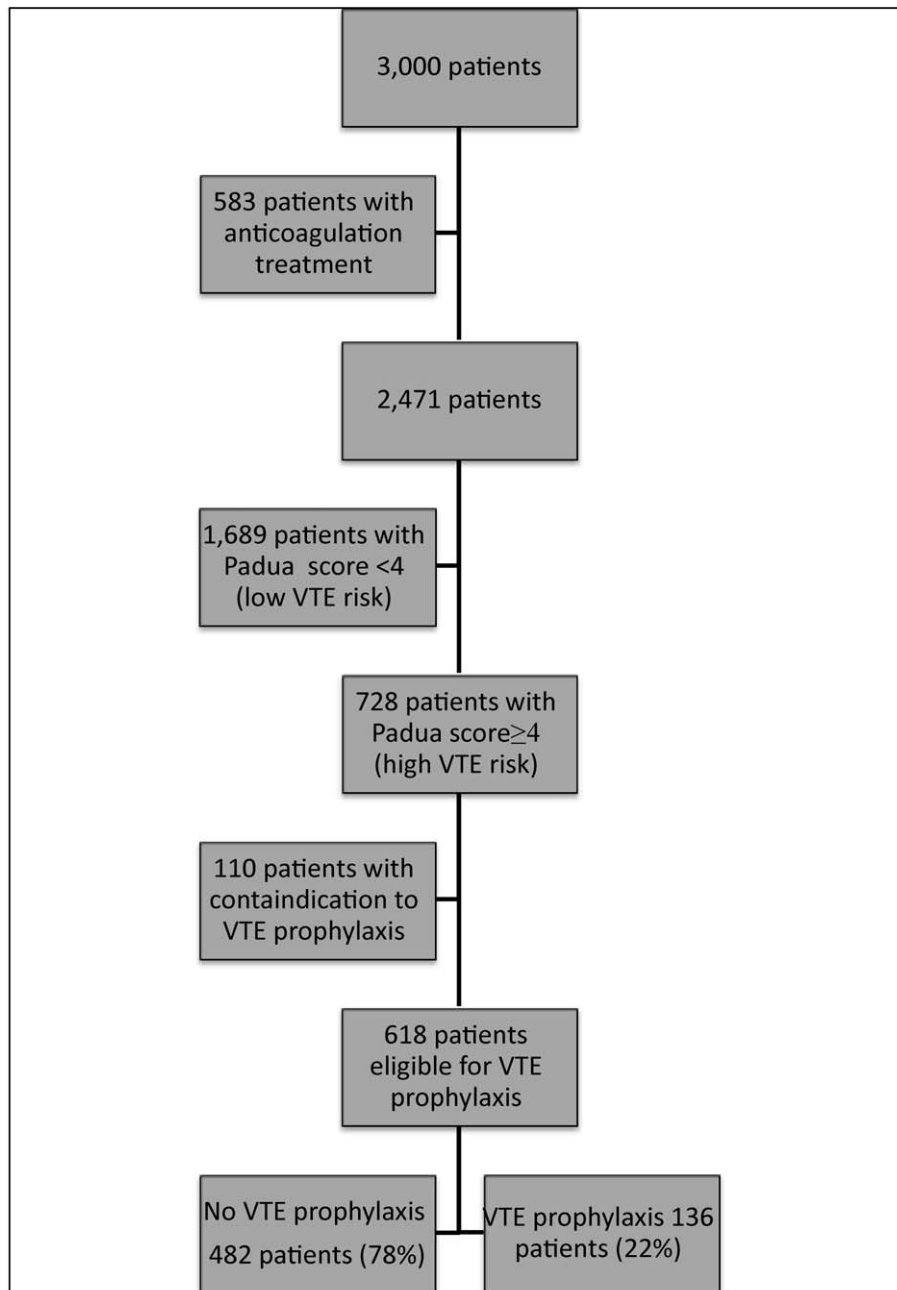
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Figure 2. Indications and contraindications for venous thromboembolism (VTE) prophylaxis in 3000 consecutive patients admitted to medical ward at 2013 and the rate of VTE prophylactic treatment in 618 eligible (no new or chronic anticoagulant treatment, Padua score ≥4, no contraindication) patients.

Table 3

Contraindications for venous thromboembolism prophylaxis in 110 patients[22].

Risk factor	Number of patients (%)
Thrombocytopenia (<75,000 plt/μL)	38 (34.5)*
Recent active bleeding (3 mo)	37 (33.6)
Liver disease with international normalized ratio >1.4	18 (16.3)
Brain hemorrhage in the last year	13 (11.8)
Active peptic disease	10 (9.1)
Blood clotting disorders	4 (3.6)
Heparin-induced thrombocytopenia in the past	1 (0.9)
Drug allergy	1 (0.9)

* Several patients had more than one contraindication for venous thromboembolism prophylaxis.

Three hundred and five patients (10.17%) died within 3 months of their medical admission (137 during hospitalization and 168 patients within 3 months following their discharge). The death rates during hospitalization as well as during the 3 months follow-up were higher among the patients who received VTE prophylaxis as compared to the eligible patients who did not get preventive treatment (19.6% vs 11.5%; $P = .0675$ and 27% vs 12.2%; $P = .038$ for in-hospital and 3 months deaths, respectively). The main causes for death, as was defined by the treating physicians, were: sepsis (36%), severe pneumonia (12%), metastatic cancer (10%), and heart diseases (8%). VTE was not defined as the cause of death in any of the patients.
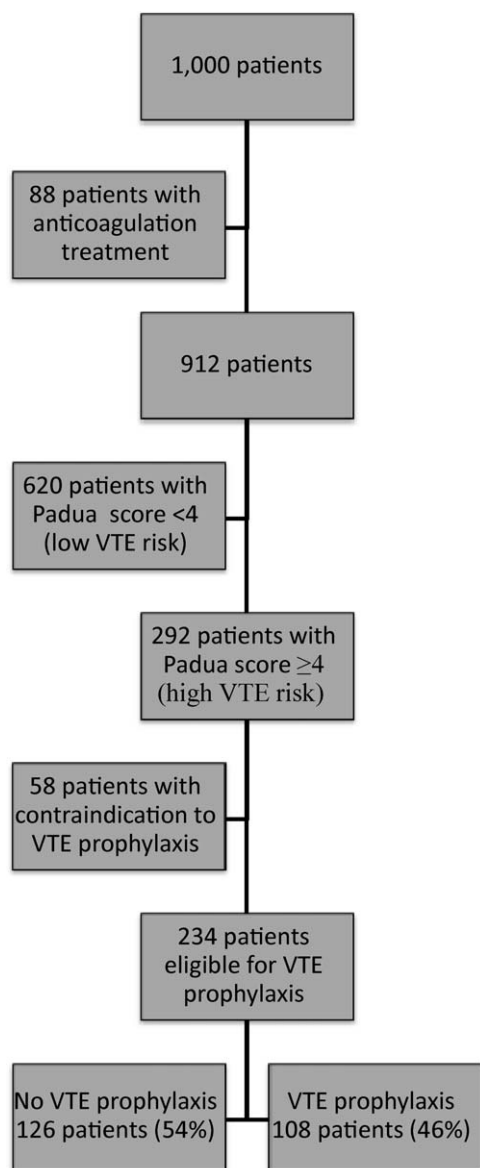
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Figure 3. Indications and contraindications for venous thromboembolism (VTE) prophylaxis in 1000 consecutive patients admitted to medical ward at 2018 and the rate of VTE prophylactic treatment in 234 eligible (no new or chronic anticoagulant treatment, Padua score ≥4, no contraindication) patients.

Only 6 of our 2417 study patients (0.24%) were diagnosed with DVT/PE within 3 months of their admission (4 during hospitalization and 2 thereafter within 3 months). Two of those patients did not have an indication for VTE prophylaxis (Padua score <4). The other 4 patients had an indication for VTE prophylaxis at the time of their medical admission (Padua score ≥4) (2/1689; 0.12%, 4/728; 0.55%, $P = .071$). Three of those eligible patients developed VTE despite thromboprophylaxis.

Since during the year of 2018, 2 years following the implementation of VTE prophylaxis program, almost all patients (98.6%) were screened for VTE risk stratification (Padua score assessment) (Fig. 1), it was of interest to determine whether more eligible patients for VTE prophylaxis (no new or chronic anticoagulant treatment, Padua score ≥4, no contraindications)

did receive the recommended treatment. To this end, we also studied 1000 consecutive patients who were admitted to the same medical wards during January till the end of March 2018. As can be seen in Figure 3, 234 out of 1000 patients, 23.4%, were eligible for VTE prophylaxis. Higher rate of those patients (46%) did receive VTE prophylaxis as compared to 22% observed in the 2013 cohort of patients ($P = .0001$) (Figs. 1–3).

4. Discussion

The VTE is a common preventable cause of morbidity and mortality in hospitalized medical patients.[23,24] Thromboprophylaxis with anticoagulants has been shown to be both effective and safe.[25–27] Thus, evidence-based guidelines recommended thromboprophylaxis for acutely ill patients, hospitalized in medical wards, who are at risk to develop VTE.[19] Despite those recommendations, VTE prophylaxis remained underused and only a 3rd of at risk medical patients are treated appropriately.[2,28,29] We present here a large (4000 patients) retrospective "real-life" study of patients hospitalized in medical departments defining the rate of patients eligible and treated for VTE prophylaxis, the complications of the treatment and the outcome of those patients.

The 1st crucial step for appropriate thromboprophylaxis is to define, at the time of admission to the medical ward, the patients who are at risk to develop VTE (Padua score ≥4[20]) ("patients at risk"). Those patients are the potential candidates for VTE prophylaxis.[19] In the 1st part of our study (3000 patients; 2013), routine VTE risk assessment by the treating physicians was done in only 13% of the hospitalized patients (Fig. 1). This low rate most probably resulted from lack of knowledge, lack of time, lack of effective, and easy methodology incorporated into the physician's operative work flow and the focusing on the current active illness rather than preventing potential diseases.[2,21,30–32] Several educational programs did not change the low VTE risk assessment rate. However, 2 years following the inclusion of VTE risk assessment (Padua score) in the internal medical departments national quality parameters, the performance rate increased to almost 100% (Fig. 1). Indeed, the higher rate of VTE risk assessment, at 2018, was associated with doubling ($P = .005$) the number of patients who properly received VTE prophylaxis (Fig. 1). This higher prophylaxis rate resulted, most probably, from a better awareness and knowledge of the treating physicians following Padua score implementation program. Interestingly, similar increase in CHADS2 assessment (for anticoagulation in atrial fibrillation) was observed following its inclusion into the national medical quality parameters. Thus, the inclusion in the national quality control parameters is a very effective method to enhance new medical preventive interventions.

Twenty-one percent of our patients (20.6% in 2013 and 23.4% in 2018 cohorts) were eligible for thromboprophylaxis (Figs. 2 and 3). All those patients had Padua score of 4 or more (Table 2), and they were neither treated with anticoagulants (chronic/acute) for other diseases (e.g., VTE, atrial fibrillation, acute coronary syndrome) nor they had any contraindication for anticoagulants prophylaxis treatment (Table 3; Figs. 2 and 3). A large (37,356 medical patients) multinational cross-sectional study (ENDORSE) reported that 41.5% of patients acutely hospitalized in medical departments are at risk to develop VTE (21–71% between different countries).[2] It should be noted that in the later study,[2] only patients admitted for VTE treatment were excluded. We believe that defining the eligible patients

(patients at risk without current anticoagulant treatment for other diseases or contraindication for VTE prophylaxis), as presented in our study, is more relevant for clinical practice. Thus, about a quarter of patients hospitalized in medical departments are eligible candidates for VTE prophylaxis.

The rate of patients at high risk for VTE who had contraindications for VTE prophylaxis in our study was 16% (15% and 19% among the 2013 and 2018 cohorts, respectively) (Figs. 1 and 2). This is similar to the rates reported in previous studies of medical patients (10% in the ENDORSE study[2], 16.1% in Jordanian study[32]) and lower than the rate (31%) reported recently in a small (205 patients) Israeli study.[28] The main contraindications for thromboprophylaxis in our study were thrombocytopenia and recent active bleeding, whereas coagulation disorders and previous HIT were observed in a very small number of eligible patients (Table 3).

The patients of our study are typical patients hospitalized in medical departments. The age, gender, and the reasons for hospitalization of our patients (Table 1) are similar to other reports from Israel[33] and from other parts of the world.[2] Moreover, the main reasons for hospitalization and the VTE risk factors of our patients (Tables 1 and 2) were similar to that of the three major thromboprophylaxis studies.[25–27] The mean age of our patients was similar to the age of the patients in the PREVENT study (68.5 years[26]), though the patients in 2 other thromboprophylaxis studies were older (MEDENOX[25], ARTEMIS[27]).

The fact that only 13% of the patients in the entire 2013 cohort were evaluated for VTE risk (Fig. 1) may explain the very low rate (22%) of thromboprophylaxis in those patients (Figs. 1 and 2). During 2018, risk stratification was done for almost all hospitalized medical patients, but still VTE prophylaxis was given to only 46% of eligible patients (Figs. 1 and 3), though it was significantly higher as compared to the rate observed among the 2013 cohort. This relatively low rate is similar to other reports from Israel[28] and from other parts of the world.[2,29,32] The low VTE prophylaxis rate may result from the fear of bleeding and from focusing on the current complex illness of medical patients rather than preventing future possible illness by the treating physicians. The higher rate of VTE prophylaxis in eligible surgical and orthopedic patients[2,32] may result at least in part from the fact that, for the later patients, VTE prophylaxis guidelines were established prior to the recommendtions for medical patients.

About 1% of patients at low risk for VTE (Padua score <4) in our study received thromboprophylaxis as compared to a much higher rate (29%) reported in the ENDORSE study.[2] This reflects the legitimate decisions of the treating physicians, in the 2 retrospective studies, that some patients may benefit from prophylaxis though they were not defined as patients with high VTE risk.

Minor bleeding events were observed in 11% of the patients who received thromboprophylaxis in our study. There were no deaths, surgical procedures, or need for blood transfusions in any of those patients. Our results are similar to those observed in the MEDENOX study (10.8% minor bleeding[25]) but higher in comparison to the reports of the ARTEMIS study (major 0.2% and minor 2.6% bleeding[27]) and the PREVENT study (major 0.49% and minor 1.03% bleeding[26]). Those differences most probably resulted from different definitions of minor bleeding events in the various medical studies. In surgical wards, a large meta-analysis reported higher rates of bleeding

complications (major 0.3% and minor 16.2%) following thromboprophylaxis.[34]

The overall VTE rate (during hospitalization and 3 months following discharge) observed in the patients of our study was quite low (0.24%; 0.55% in patients at risk with Padua score ≥4 and 0.12% in patients with Padua score <4; P = .071). Since consecutive routine elective compression ultrasound Doppler examinations were not done in our study, all events were symptomatic VTE. The low VTE rate observed in our study is similar to previous reports of symptomatic VTE in hospitalized medical patients (0.1–1.5%[25–27,30]). The fact that our study was a retrospective study probably leads to underestimation of symptomatic VTE events. This is in contrast to the reported rates of VTE diagnosed by routine compression ultrasound Doppler (up to 14.9%[25–27]).

The low rate (0.24%) of VTE observed in the study, as well as the low number of eligible patients who received thromboprophylaxis (Figs. 1–3) in a nonrandomized fashion prevent the ability to evaluate the efficacy of VTE prophylaxis in our retrospective study. It should be noted that the mortality and VTE event rates were higher among eligible patients who received thrombophylaxis. We believe that this is not due to the lack of thromboprophylaxis efficacy. Since the use of thrombophylaxis in our study was not randomized, confounding factors mainly the severity of the patients' illness probably influenced the treating physician to give VTE prophylaxis. Indeed, eligible patients who received thromboprophylaxis had significantly higher Padua score (5.36 vs 4.94; P = .0001), longer duration of hospital stay (8.36 vs 4.2 days for patients who received VTE prophylaxis and other patients, respectively) and higher non-VTE-related death rates than those without VTE prophylaxis.

Since, as was observed in our study, some VTE events may occur after discharge of the patients from the medical ward, several studies suggest extended thromboprophylaxis (up to 42 days) for patients at risk.[35–38] The initial extended thromboprophylaxis studies in acutely ill medical patients with low molecular weight heparin and with oral anticoagulants (Rivaroxaban, Apixaban) showed benefit in VTE prophylaxis reduction that was out weighted by increased bleeding.[35,37]

Recently the APEX study[38,39] compared the efficacy of short (10 days) enoxaparin treatment with extended (35–42 days) prophylaxis with betrixaban (long acting factor Xa inhibitor with a minimal renal clearance) in medical hospitalized at VTE-risk patients. The extended betrixaban (which was initiated at day 1 without low molecular weight heparin) thromboprophylaxis was more effective than the short treatment with enoxaparin (relative risk reduction 25%; P = .006) without an increase in bleeding.[37–39] It appears that patients with reduced mobility, active malignancy, prothrombotic conditions, and a positive D-dimer assay will benefit from extended thromboprophylaxis.[35]

We used in our retrospective study the Padua score as the risk assessment model (RAM) to stratify the risk of VTE,[20] since this is the RAM routinely used in our medical center. Moreover, this is the score that was adopted by the ACCP 9 guidelines.[19] There are several other RAMs for VTE prophylaxis in medical inpatients, but consensus about which one is better is lacking.[40] The Caprini RAM was shown to have higher sensitivity for identification patients who may benefit from thromboprophylaxis, as compared to Padua score, but the Caprini model is much more complicated and time consuming (Caprini 36 vs 11 parameters in Padua).[41] Another RAM the Geneva score was shown to be as good as the Padua score in predicting VTE events

in hospitalized medical patients. The Geneva score was more accurate in identification of low-risk patients who do not require thromboprophylaxis.[42] The Geneva score like the Caprini model is quite time consuming (questionnaire of 20 parameters).[41,42] Thus it may limit the usage of the latter 2 RAMs in routine clinical practice.

D-Dimer test is a useful tool for the diagnosis of DVT/PE though the test has several limitations.[43] The D-dimer assay was shown to be highly sensitive in excluding VTE (high negative predictive value) in patients with low or intermediate clinical probability. In those patients, normal D-dimer levels exclude the need for costly imaging studies, whereas in patients with high D-dimer levels further diagnostic investigations are mandatory. On the contrary, in patients with high clinical probability for VTE, the D-dimer test is not a useful diagnostic tool for VTE diagnosis due to its low specificity in those patients.[44] However, the D-dimer assay has no rule in the assessment of medical patients' eligibility for thromboprophylaxis. Thus, D-dimer levels are not considered a risk factor in any of the DVT/PE risk assessment scores.[20,41,42]

Our study has several limitations. Firstly, it is a retrospective study. Secondly, VTE diagnosis in our study was based on clinical suspicion and not by consecutive routine ultrasound Doppler examinations. This probably led to underestimation of VTE incidence, preventing the real evaluation of VTE prophylaxis efficacy in our study. Thirdly, this study is based on data from 1 medical center. However, the patients of our study are typical patients hospitalized in medical departments regarding their age, gender, and the reasons for hospitalization.[2,24–26,32] Thus, we believe that our results are applicable to all patients hospitalized in medical departments.

To conclude about 20% of all acutely ill patients hospitalized in medical department are eligible for VTE thromboprophylaxis. Major efforts are mandatory to increase the rate of VTE prophylaxis to all, not only to the very sick, patients with high risk to develop VTE (Padua score ≥4).

Author contributions

Conceptualization: Keren Mahlab-Guri, Natalia Replianski, Shira Rosenberg-Bezalel, Zev M. Sthoeger.
Data curation: Keren Mahlab-Guri, Monged S. Otman, Natalia Replianski, Irina Rabinovich.
Formal analysis: Keren Mahlab-Guri, Natalia Replianski.
Investigation: Keren Mahlab-Guri, Monged S. Otman.
Methodology: Keren Mahlab-Guri.
Supervision: Zev M. Sthoeger.
Validation: Irina Rabinovich.
Writing – original draft: Keren Mahlab-Guri, Shira Rosenberg-Bezalel, Zev M. Sthoeger.
Writing – review & editing: Keren Mahlab-Guri, Shira Rosenberg-Bezalel, Zev M. Sthoeger.

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