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Explicit versus implicit risk assessment for the indication of antithrombotic prophylaxis in acutely ill medical in-patients

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Summary

Questions under study: The indication of venous thromboembolism (VTE) prophylaxis in acutely ill patients admitted to medical departments is not well-defined. Consensus groups have published recommendations and guidelines, addressing this issue. We investigated whether a guideline (explicit risk assessment) would improve the formerly used implicit risk assessment.

Methods: We compared two groups of patients consecutively admitted to our department during a 4-months period each. Group 1 was assessed prospectively and treated according to a guideline (explicit assessment). Group 2 consisted of the patients hospitalised in the four months prior to the introduction of the guideline (implicit assessment). Their data were abstracted retrospectively from the medical charts. Main outcome measures were symptomatic VTE and major bleedings, and the consumption of unfractionated (UFH) and fractionated (LMWH) heparins. Follow-up lasted until 90 days after hospital discharge.

Results: Symptomatic VTE occurred in 5/686 (0.7%) patients of group 1 *vs* 9/622 (1.4%) patients of group 2 during the hospital phase ($p > 0.05$), and in 9/646 (1.4%) *vs* 10/572 (1.7%) during the whole study period ($p > 0.05$). In group 1, 350 (51%) patients did not qualify for thromboprophylaxis according to the guideline, and none of them experienced any symptomatic VTE event. Three patients (0.5%) in group 1 and 4 patients (0.6%) in group 2 experienced a major bleeding event ($p > 0.05$). Average consumption of UFH and LMWH did not differ between the groups.

Conclusions: The introduction of a guideline for explicit assessment of thromboembolic risk was not significantly superior to the formerly used implicit assessment. However, based on the small number of events observed in this study, a minor advantage cannot be ruled out. Targeted indication for thromboprophylaxis, whether explicit or implicit, avoided application of UFH or LMWH in half of the patients in our setting.

Key words: thromboprophylaxis; internal medicine; implicit versus explicit risk assessment

Introduction

The indication for prophylactic antithrombotic treatment to prevent venous thromboembolism (VTE) in hospitalised acutely ill medical patients is less well-defined than in surgical patients. The use of prophylaxis in patients with ischaemic stroke [1] and acute myocardial infarction [2] has shown to be beneficial. For other patients the indication for VTE prophylaxis is less clear as the results of the studies are contradictory, especially when mortality is the main outcome measure [3–7]. A recent meta-analysis of randomised trials concluded that heparins are beneficial in the prevention of VTE in internal medicine [8]. Moreover, in a recent randomised trial 40 mg enoxaparin was effective in preventing VTE in selected acutely ill medical patients. In this study over 90% of VTE events were asymptomatic. There was a marginal positive effect regarding the prevention of symptomatic VTE during the hospital phase, but not during the follow-up period. However, compared to the placebo group one more death from pulmonary embolism and two more fatal haemorrhages in the 40 mg enoxaparin group were reported [9]. Given these potentially severe adverse effects of VTE prophylaxis, and given the still debatable clinical relevance of asymptomatic VTE treatment, it is important to select patients at high VTE risk only and to avoid unnecessary treatment. As a consequence several organisations have developed guidelines to address this issue [10–13]. The value of such guidelines has not been investigated extensively so far, and conclusions of studies were based on theoretical considerations rather than on well-defined outcomes [14–16].

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One study concluded that 17% of VTE events observed could theoretically have been avoided had the guidelines been followed correctly [14]. A Scottish study showed that guidelines could enhance the identification of medical and surgical patients at risk for VTE from 73% to 97%, and the rate of correctly used prophylaxis from 55% to 96% [15]. A retrospective Swiss study showed that with explicit instead of implicit criteria the percentage of patients receiving thromboprophylaxis could theoretically have been diminished from 43.1% to 37.6%. Moreover, based on implicit criteria about half of the patients were unnecessarily treated and over 40% of the patients who should have been treated based on the explicit criteria were not [16].

Thus, the value of a formal guideline-based risk assessment (explicit criteria) compared to "usual care" (implicit assessment) has not been studied so far in daily clinical practice, measuring well-defined clinical outcomes. Important goals of the introduction of a guideline are a reduction in the number of VTE and bleeding events, and a reduced consumption of unfractionated heparin (UFH) or low molecular weight heparin (LMWH) as a result of more targeted indication. We therefore decided to study the effect of a formal guideline-based risk assessment (explicit criteria) compared to "usual care" (implicit assessment). The formal guideline-based risk assessment group (group 1) was unselected and recruited consecutively. Group 2 contained patients that were admitted prior to the introduction of the formal guideline. Main outcome measures were symptomatic VTE and bleeding events during hospital stay and until 90 days after discharge, and the total consumption of heparins.

Methods

Setting

The Department of Internal Medicine of the Cantonal Hospital of Schaffhausen (Switzerland) is a tertiary care centre with 80 beds and the only medical department serving a region of approximately 80 000 inhabitants; patients are non-selected and the disease spectrum is broad. The staff of the department consists of 13 residents in General Internal Medicine, who usually rotate every two years, and six staff physicians and attendants with a specialty in General Internal Medicine. The department admits approximately 2200 patients per year.

Participants, design of study, and outcome measures

We compared two groups of patients consecutively admitted over a period of 4 months each. All patients were included into the analysis without exception. The patients of the intervention group received thromboprophylaxis based on explicit criteria. These criteria were established – with slight modifications – according to the recommendations of an international consensus group [10]. Immobile patients who additionally had at least one of the following risk factors were advised to be treated prophylactically with antithrombotic agents: acute myocardial infarction; acute stroke; paralysis or paresis for other reasons; acute heart failure; severe pneumonia or exacerbation of chronic obstructive pulmonary disease; treatment in the intensive care unit; active malignancy; nephrotic syndrome; chronic inflammatory bowel disease; previous venous thromboembolism; known thrombophilic state (deficiency of antithrombin III, protein C, protein S, presence of lupus anticoagulant); myeloproliferative disease; severe dehydration (eg due to diabetic ketoacidosis or hyperosmolar coma, fever or gastroenteritis); cast on one or both lower extremities; overweight (body mass index over 30 kg/m^2); treatment with estrogens. Immobilisation was defined as being unable to walk alone in the room at least 3 times per day for several minutes.

The indication for continuation of prophylaxis was assessed daily. Prophylactic treatment was stopped as soon as the criteria were no longer applicable for the patient (ie either when the patient was no longer immobile and/or when none of the above mentioned risk factors were present), or latest upon discharge from the hospital. Patients with a contraindication (see below) were not given prophylaxis. The treating physicians were free to accept the guideline for an individual patient or to reject it. In case of rejection, a written statement defining the reason for rejection was required on the case report form .

The patients of the implicit assessment group consisted of a cohort admitted to the medical department in the 4-months period prior to the start of the intervention. In these patients, the physicians chose to start and stop prophylactic antithrombotic treatment based on their personal judgement without formal risk assessment.

The occurrence of the main outcome measures during the hospital stay and until 90 days after hospital discharge was compared between the two groups. Main outcome measures were the number of symptomatic deep vein thrombosis or pulmonary embolism; the number of major bleeding events; and the total consumption of antithrombotic drugs (UFH and LMWH). Major bleeding was defined as bleeding leading to hypotension, erythrocyte substitution or a fall of the haemoglobin level of ≥2 g/dl.

Data registration

Hospital stay

For each patient of the intervention group a standardized case report form had to be filled out by the physician in charge containing the following items: age; gender; main diagnosis; immobilisation (yes/no); further risk factors for venous thromboembolism according to a checklist as listed above; decision for thromboprophylaxis (yes/no); contraindication for thromboprophylaxis (known allergic reaction to heparins, thrombocytopenia <80 000/mm^3, known bleeding risk or active bleeding, scheduled operation or peridural anaesthesia); and choice of antithrombotic drug (enoxaparin 2000 IU (20 mg) for patients ≤60 kg of bodyweight or 4000 IU (40 mg) for patients >60 kg given subcutaneously once every day, or UFH 10 000 IU intravenously as a continuous infusion over 24 hours; if anticoagulation in full dose was indicated, eg in patients with an acute coronary syndrome: enoxaparin 100 IU/kg body weight s.c. every 12 hours, or UFH starting with 20 000 IU/24 hours i.v. as a continuous infusion and adjusted to reach adequate prolongation of the thrombin time). These features were registered at the first day. During the hospital stay patients were visited daily,

and specifically checked for signs and symptoms of deep vein thrombosis (leg swelling, pain) and pulmonary embolism (chest pain, dyspnea, haemoptysis, jugular venous distention). In patients with clinical suspicion of deep vein thrombosis a duplex sonography or phlebography was performed. If symptomatic pulmonary embolism was suspected a ventilation/perfusion scan or computed tomography of the chest or, in case of death, an autopsy was performed. The physician in charge registered the following additional items: bleeding events and severity of bleeding as assessed by clinical signs and symptoms, blood pressure, pulse rate, and haemoglobin determination; death and reason for death; treatment with coumadins; total number of days on and dosage of LMWH or UFH; day of and reason for termination of prophylaxis; and, upon discharge, whether the patient was still immobile and/or whether additional risk factor(s) were still present. All data registration was checked by one of the authors (MD) every day. In case of non-compliance with the guideline, the reason was discussed and noted on the case report form. Patients who were – for any reason – on coumadins at admission continued on this drug unless they had a contraindication.

In the implicit assessment group, the same data were retrospectively abstracted from the medical charts by one of the authors (MD).

Post-discharge follow-up

A 90 days post-discharge follow-up was performed in all patients of both groups. A questionnaire was sent to the practitioners or institutions caring for the patients after discharge from our hospital. They were asked whether and when one of the following events had occurred: symptomatic VTE, bleeding, and death. In case of an event they were asked whether the patient was still on an anticoagulant drug and how the event was diagnosed.

Statistics

The χ-square test was used for comparison of categorical variables. For continuous variables, the Mann-Whitney U-test was used. For all analyses two-sided tests were used. $P < 0.05$ was considered as statistically significant. Analyses were done with SPSS Base 10.0.

The event rates of symptomatic VTE and major bleedings were calculated during the hospital stay and, separately, for the patients in whom a whole follow-up was available. Event rates were compared by calculation of odds ratios (OR) with 95% confidence intervals (CI) using StatXact, Version 5.03.

Results

Patients

All patients admitted during the respective time periods were included into the analysis. The prospectively recruited explicit assessment group (group 1) consisted of 686 patients, the retrospective implicit assessment group (group 2) consisted of 622 patients.

The two groups were comparable with respect to age, gender distribution, risk factors for VTE, contraindications for prophylaxis and an indica-

Table 1
Demographic data and risks for venous thromboembolism (VTE) in compared groups.

Characteristic	explicit assessment n = 686	implicit judgement n = 622
Age, mean (SD), years	71.5 (15.8)	72.0 (17.2)
Gender: n (%)		
Female	335 (48.8)	319 (51.3)
Male	351 (51.3)	303 (48.7)
Risk factor: n (%)		
Immobilization	369 (53.8)	N.d.*
Intensive care	116 (16.9)	97 (15.6)
Malignancy	92 (13.4)	96 (15.4)
Severe pulmonary infection	74 (10.8)	60 (9.6)
Heart failure	74 (10.8)	62 (10.0)
Stroke/paralysis	52 (7.6)	36 (5.8)
Acute myocardial infarction	37 (5.4)	47 (7.6)
History of venous thromboembolism	28 (4.1)	31 (5.0)
Overweight (BMI >30 kg/m^2)	24 (3.5)	15 (2.4)
Severe exsiccosis	12 (1.7)	12 (1.9)
Other	7 (1.0)	5 (0.8)
Number of risk factors/patient**	0.75	0.74
Full anticoagulation	96 (14.0)	96 (15.4)
Contraindication for heparins	56 (8.2)	61 (9.8)
Length of hospital stay, median (range), days	9.0 (1–162)	9.0 (1–104)

* N.d.: not determined
** without immobilisation

Table 2
Symptomatic venous thromboembolism (VTE) and major bleeding events during hospital stay and 90-days after discharge.

Outcome	explicit assessment	implicit judgement	Odds ratio (95% CI)	p
In-hospital				
No. of patients evaluated	686	622		
VTE: n (%)	5 (0.7)	9 (1.4)	0.50 (0.13–1.67)	0.32
Major bleeding: n (%)	2 (0.3)	3 (0.5)	0.60 (0.10–3.58)	0.89
Death (p.e.* or bleeding) **	4 (0.6)	6 (1.0)	0.60 (0.12–2.55)	0.64
In-hospital plus follow-up				
No. of patients evaluated	646	572		
VTE: n (%)	9 (1.4)	10 (1.7)	0.79 (0.28–2.19)	0.79
Major bleeding: n (%)	3 (0.5)	4 (0.6)	0.70 (0.15–2.97)	0.87
Death (p.e.* or bleeding) **	6 (0.9)	7 (1.2)	0.76 (0.21–2.65)	0.82

* p.e.: pulmonary embolism
** Death from p.e. and death from bleeding: in-hospital 2 and 2 for explicit assessment, 6 and 0 for implicit judgement; follow-up 2 and 0 for explicit assessment, 1 and 0 for implicit judgement

tion for full anticoagulation (table 1). Immobilisation was often not explicitly stated in the charts of the retrospective group (group 2) and thus could not be evaluated in this group. Without immobilisation, the mean number of risk factors per patient was 0.75 in group 1 and 0.74 in group 2.

In group 1, 369 patients (53.8%) were immobile at admission to the department. Of these, 337 (91.3%, or 49% of the whole group) had at least one additional risk factor for VTE and qualified for prophylaxis according to the guideline. Compliance with the guideline was 96.4%. The guideline was rejected by the treating physicians in 25 patients (3.6%). Reasons for rejection were a poor condition of the patient, mostly due to advanced untreatable cancer (20 patients); foreseeable short immobilisation for only a few hours (2 patients); young patients in good clinical condition admitted to the ICU for supervision purposes only (2 patients); and one patient in whom prophylaxis was erroneously omitted. No patient received prophylaxis without indication according to the guideline.

Thromboembolic and bleeding events during hospital stay

During the hospital stay, five patients in the explicit assessment group 1 (0.7%) and nine patients in the implicit assessment group 2 (1.4%) experienced symptomatic thromboembolic events ($p > 0.05$) (table 2). In group 1, three patients had pulmonary embolism, two of which died. Both suffered from advanced malignant disease. Two patients had deep vein thrombosis and survived. All patients with VTE had a formal indication for thromboprophylaxis according to the guideline. In the two patients who died from pulmonary embolism the treating physicians withheld prophylaxis based on their poor condition with end-stage malignant disease. In two patients symptomatic VTE occurred despite prophylaxis with enoxaparin 2000 IU/day, and in the fifth patient prophylaxis was erroneously omitted despite indication according to the guideline. VTE did not occur in any of the patients without indication for thromboprophylaxis according to the guideline during the hospital phase.

Of the nine patients with VTE in group 2, one patient had iliofemoral vein thrombosis and survived. Eight patients had pulmonary embolism. Three of the nine patients with VTE had received thromboprophylaxis as of the first day of admission, two of which died from pulmonary embolism. VTE occurred on day 4, 20 and 50 while receiving prophylaxis with oral anticoagulants for previous pulmonary embolism (INR 1.6), enoxaparin 4000 IU/d, and enoxaparin 14000 IU/d, respectively. Six of the nine patients with VTE had not received thromboprophylaxis. Two had obvious contraindications, one of which died from pulmonary embolism. In the other four patients prophylaxis was not given for unknown reasons, and three of them died from pulmonary embolism. All of them had a severe underlying disease (2 end-stage malignancies, one severe katatonia). Retrospectively, according to the guideline introduced later for group 1, all four patients had risk factors for VTE (two with malignancies, one with paresis, one with immobilisation due to katatonia).

There was no difference in the occurrence of major bleedings between the two groups (table 2). In two patients of group 1 bleeding was fatal. A 91 years old patient with cirrhosis of the liver and a formal indication for prophylaxis received enoxaparin 2000 IU/day by the first day and experienced bleeding from formerly unknown oesophageal varices on day 12 and died. An 84 years old patient received full anticoagulation with enoxaparin 5000 IU b.i.d. because of newly detected atrial fibrillation. He experienced a large bleeding of the chest wall on the seventh day, became severely hypotonic and died one day later from multiple organ failure. The other three patients with significant bleeding belonged to group 2 and had received full anticoagulation for atrial fibrillation in two and acute myocardial infarction in one patient. Thus, only one patient who was given LMWH in "prophylactic" dosage had a severe bleeding.

Thromboembolic and bleeding events during post-discharge follow-up

In the post-hospital phase 5 patients experienced VTE. Four belonged to group 1, one to group 2. All of them had received prophylaxis during hospitalisation. Three of these patients died from pulmonary embolism: one patient with lung carcinoma after five days despite full anticoagulation during hospital stay and after discharge, the other two patients 14 and 90 days after discharge and prophylactic treatment during the hospital stay for 14 and 22 days, respectively. In no patient of group 1 who had not qualified for prophylaxis according to the guideline did any VTE occur during follow-up.

2 patients who had been given thromboprophylaxis during hospital stay but no further antithrombotic treatment after discharge experienced a major bleeding. These occurred 53 and 89 days after discharge, respectively. Therefore, a causal relationship with thromboprophylaxis is very unlikely.

Summary of events for whole study period

After discharge from hospital, seven patients could no longer be evaluated because their data were lost (one in group 1 and six in group 2). In an additional 83 patients a follow-up was not available (39 in group 1, 44 in group 2), because 2 practitioners declined to give information and 7 practitioners could not be contacted. Moreover no data were available for these patients from the hospital registry. Thus, 646 patients of group 1 (94.2%) and 572 patients of group 2 (92%) could be analysed for the whole study period.

VTE occurred in 1.4% of group 1 and in 1.7% of group 2 ($p > 0.05$) (table 2). 0.6% of patients in group 1 and 1.2% of patients in group 2 died from VTE ($p > 0.05$).

The rate of major bleedings did not differ between the two groups (table 2). Death due to pulmonary embolism or major bleeding occurred in 0.9% of patients in group 1 and 1.2% of patients in group 2 ($p > 0.05$). In group 1, no patient who had not qualified for thromboprophylaxis according to the guideline experienced any event of venous thromboembolism during the whole observation period.

Consumption of heparins

311 patients in group 1 (45.3%) and 282 patients in group 2 (45.3%) were treated with UFH or LMWH. The mean duration of treatment per patient that was hospitalised was 4.3 and 4.5 days, respectively. The mean treatment duration per patient receiving UFH or LMWH was 9.1 days and 9.6 days, respectively. 179 patients (26.1%) in group 1 and 139 patients (22.3%) in group 2 received full dose UFH or LMWH ($p > 0.05$) for one day or longer at any time during the hospital stay. The mean (standard deviation, SD) total dose of UFH per patient hospitalised was 12 600 IU (41 100) in group 1 and 12 800 IU (42 900) in group 2. The mean (SD) total dose of LMWH (enoxaparin) was 20 000 (39 100) IU and 21 000 (41 200) IU, respectively. 14.0% of patients in group 1 and 15.4% in group 2 had full anticoagulation with coumadins.

Discussion

In this study performed at a middle-sized medical department which admits unselected acutely ill patients, the introduction of a formal guideline based on explicit criteria for the indication of VTE prophylaxis did not lead to improved outcomes. The rate of symptomatic VTE and major bleedings as well as the total consumption of heparins (UFH und LMWH) remained unchanged. It is to our knowledge the first study assessing the utility of a thromboprophylaxis guideline in medical patients on the basis of well-defined events.

The role of prophylactic treatment of VTE in acutely ill medical patients is still undefined. Whereas most agree that treatment is indicated for patients with acute ischaemic stroke [1] or acute myocardial infarction [2], no agreement exists with respect to other diseases [3–9]. Agreement neither exists with respect to the best outcome measure for prophylaxis use being symptomatic and/or asymptomatic VTE, or mortality [3]. Thus, there is still uncertainty which medical patients without a contraindication should receive prophylactic treatment. Given the potential adverse effects and regarding the costs of prophylaxis, only patients at risk of VTE should be treated. Therefore, consensus groups have published guidelines, one of which [10] was used for our analysis with some minor modifications. Based on our results a targeted indication is feasible, and not every acutely ill medical patient is in need of prophylaxis: less than half of the patients of group 1 (explicit risk assessment group) had an indication for prophylaxis according to the guideline, and symptomatic VTE did not occur in any non-prophylaxis indicated patient during the hospital stay or in the 90-day post-hospital phase.

In this analysis, an explicit risk assessment did not work significantly better than intuitive judgement with respect to the indication of prophylaxis. The most likely reason is, that if immobilization – the intuitively most important and most easily recognizable risk factor – was present, it was associated with at least one further risk factor in over 90% of patients. Thus, almost all immobilized patients qualified for thromboprophylaxis according to the guideline. This implies that including risk

factors in addition to mobility as a criterion for prophylactic treatment only minimally changes the outcome of the risk assessment. The definition of immobilization used in this study is somewhat arbitrary, but seemed reasonable to us in the absence of a standard definition in the literature.

The aim of this study was not to validate the guideline used. Nevertheless, since no patient who did not qualify for thromboprophylaxis experienced symptomatic VTE, it can be concluded that it covered all patients at risk. It is unknown how a more restrictive guideline, which includes fewer patients for prophylaxis, would perform.

The rate of symptomatic VTE and major bleeding events observed in our study was in accordance with the literature [3–7, 9].

Our analysis has several strengths. First, we studied the effect of a formal risk assessment for VTE on well-defined clinical outcomes. Earlier research evaluating the utility of consensus guidelines lacked well-defined clinical endpoints and their conclusions were based on theoretical considerations [14–16]. Second, our patient population was unselected and included the whole spectrum of acutely ill medical patients necessitating hospital care. All patients who were hospitalised in two defined time periods were studied. Third, follow-up was long and almost complete (92%). Forth, during the pre-intervention period the medical team was not informed about the study in order to maximise objective data collection. Moreover, between the two study periods the medical team was almost unchanged, which limited potential observer bias.

Some limitations should be noted. First, it was not a randomised trial. However, the risks for VTE were well matched between the two groups (table 1), making bias due to different patient populations unlikely. Moreover, using an open before/after design has the advantage of avoiding knowledge contamination between the medical teams. Yet, we cannot exclude a degree of ascertainment bias with respect to the VTE frequency in the prospectively worked up patients (group 1). Second, data from the control cohort were collected retrospectively from the medical charts. However, all data of interest were available. Lacking data concerning immobilisation, prevented us from analysing retrospectively which proportion of patients of the control group was treated appropriately according to the later introduced guideline. This also withheld us from assessing the impact of the guideline on the indication for prophylaxis. However, this has been studied by others [16]. It was not the aim of our study, which would then have been designed differently. Our aim was to analyse the effect of a guideline on the number of preventable events. Third, practitioners followed up patients, and data concerning VTE and bleeding were collected using a questionnaire. We thus relied on the practitioners' diagnosis. The frequency of observed symptomatic VTE after hospital discharge (0.5%) is in the same order of that observed in a recent randomised controlled trial [9]. Therefore, significant under- or overdiagnosis is unlikely. Forth, we restricted our analysis to symptomatic VTE. Including asymptomatic events might have changed the results and the conclusions. However, the clinical relevance of asymptomatic VTE as to the progression into symptomatic VTE is still undefined and may be small. Asymptomatic deep vein thrombosis has been found to be quite frequent in medical patients (about 10 to 20 times as frequent as symptomatic deep vein thrombosis) [9]. Extrapolating these data to our study population, in which 14 in-hospital symptomatic VTE occurred, approximately 140 asymptomatic VTE would have occurred. Yet, in the post-hospital phase, only five patients experienced a symptomatic VTE. Moreover, all of them had received thromboprophylaxis during hospitalisation, thereby minimising the risk for asymptomatic VTE. Fifth, as can be seen in table 2, the 95% confidence intervals of the odds ratios are rather wide due to the small number of observed events. Therefore, a missed true difference remains a possibility. Based on the VTE frequency in our study, a minimum of 26 000 patients should have been included in each group to detect a 20% decrease of VTE with an α of 0.05 and a power of 0.8. Even if focussing on the events during the hospital phase only, where there was a stronger trend favouring explicit assessment, tripling the sample size would be needed to reach a statistically significant difference, provided the same frequency of symptomatic events in each group can be expected. Thus, further studies should include more patients if symptomatic VTE is the main outcome measure. Sixth, patients weighing less than 60 kg were treated with 2000 IU enoxaparin, and those over 60 kg with 4000 IU. This discrimination according to the body weight contradicts the conclusions of the MEDENOX-study [9]. However, our study was performed before publication of MEDENOX. Moreover, it is unlikely that uniform dosing with 4000 IU enoxaparin would have changed the results significantly, since the dosing regimens in both groups were similar. Finally, the experienced chief residents and attendants who supervised the physician-trainees closely were probably well aware of the potential risks for VTE already before the introduction of the guideline. An explicit risk assessment according to a guideline may well prove to be advantageous in a setting with different medical staff. Also, a different guideline may yield other results.

In conclusion, the study demonstrates that in our institution the introduction of an explicit risk assessment for the indication of VTE prophylaxis in acutely ill medical patients, did not improve the previously used implicit assessment. Our study is able to rule out a major difference in the event rates between the two groups, though a small difference in favour of explicit assessment cannot be ruled out. Moreover, prophylaxis was omitted in about half of our patients without negative consequences. Fur-

ther research is necessary to find out if results are different in other settings or with other guidelines.

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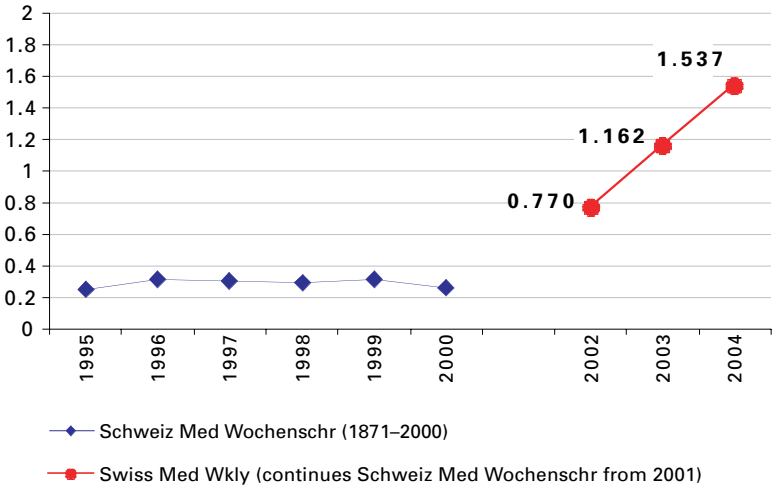

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