Effectiveness and Safety of Apixaban for Treatment of Venous Thromboembolism in Daily Practice

Stephan V. Hendriks1,2 Frederikus A. Klok1 Wilhelmina J.E. Stenger1 Albert T.A. Mairuhu1,2 Jeroen Eikenboom1 Jaap Fogteloo3 Menno V. Huisman1

1 Department of Thrombosis and Hemostasis, Leiden University Medical Center, Leiden, The Netherlands
2 Department of Medicine, Haga Teaching Hospital, The Hague, The Netherlands
3 Department of Internal Medicine, Leiden University Medical Center, Leiden, The Netherlands


Address for correspondence Stephan Hendriks, MD, Department of Thrombosis and Hemostasis, Leiden University Medical Centre, Albinusdreef 2, 2300 RC Leiden, The Netherlands (e-mail: s.v.hendriks@lumc.nl).

Abstract

Introduction Phase 3 trials have shown comparable efficacy of direct oral anticoagulants (DOACs) and vitamin K antagonists in patients with acute venous thromboembolism (VTE), with less major bleeding events in patients randomized to DOAC treatment. With DOACs being increasingly used in clinical practice, evaluation of the DOACs in daily practice-based conditions is needed to confirm their safety and effectiveness. The aim of this study is to evaluate the effectiveness and safety of apixaban in VTE patients in daily practice.

Methods In this retrospective cohort study, consecutive patients diagnosed with VTE in two Dutch hospitals (Leiden University Medical Center, Leiden and Haga Teaching Hospital, The Hague) were identified based on administrative codes. We assessed recurrent VTE, major bleeding and mortality during a 3-month follow-up period in those treated with apixaban.

Results Of 671 consecutive VTE patients treated with apixaban, 371 presented with acute pulmonary embolism (PE) and 300 patients with deep-vein thrombosis. During 3 months treatment, 2 patients had a recurrent VTE (0.3%; 95% confidence interval [CI]: 0.08–1.1), 12 patients had major bleeding (1.8%; 95% CI: 1.0–3.2), and 11 patients died (1.6%; 95% CI: 0.9–2.9), of which one patient with recurrent PE and one because of an intracerebral bleeding.

Conclusion In this daily practice-based cohort, apixaban yielded a low incidence of recurrent VTE, comparable to the phase 3 AMPLIFY study patients. The incidence of major bleeding was higher than in the AMPLIFY-study patients, reflecting the importance of daily practice evaluation and the fact that results from phase III clinical studies cannot be directly extrapolated toward daily practice.

Keywords ► apixaban ► direct oral anticoagulants ► safety ► efficacy ► venous thromboembolism

Introduction Direct oral anticoagulants (DOACs) inhibit either thrombin (dabigatran) or activated factor X (apixaban, edoxaban, and rivaroxaban). Over the last years, DOACs are increasingly being used to prevent ischemic stroke in patients with atrial fibrillation and to treat acute venous thromboembolism (VTE). According to international treatment guidelines, the use of DOACS is being preferred over vitamin-K antagonists (VKA) for these two indications.1–4 In VTE treatment, phase 3 studies have shown comparable efficacy of DOACs and VKA, with a better bleeding profile.5–10 Furthermore, at prolonged treatment after the
initial 6 months, DOACs have proven to be superior to placebo or aspirin for secondary VTE prevention.11,12

Importantly, as phase 3 trials dictate to have strict in- and exclusion criteria both efficacy and bleeding rates may be underestimated because patients at higher risk of bleeding are usually excluded. With DOACs being increasingly used in clinical practice, evaluation of the DOACs using practice-based data sources is needed to better delineate their effectiveness and safety. Such data focusing on safety of apixaban for treatment of VTE are scarce.

In this study, we evaluated the efficacy and safety of apixaban in patients with VTE treated in two hospitals in the Netherlands.

**Methods**

**Design and Patients**

In this retrospective cohort follow-up study, consecutive patients diagnosed with VTE between January 2016 and December 2018 in two Dutch hospitals (Leiden University Medical Center, Leiden and Haga Teaching Hospital, The Hague) were identified via the hospitals’ administrative system. Patients were eligible for inclusion if they were 18 years or older and had established acute symptomatic or incidental pulmonary embolism (PE) involving subsegmental or more proximal pulmonary arteries confirmed by computed tomography pulmonary angiography (CTPA), or symptomatic or incidental deep-vein thrombosis (DVT) of the lower or upper extremities, involving the popliteal, femoral, iliac, subclavian, axillary or brachial vein or the inferior vena cava, diagnosed by compression ultrasound or CT venography, or by a positive signal on magnetic resonance direct thrombus imaging (DTI) indicative of fresh thrombus in the proximal veins of the leg.13–15

Patients were included in this study when the physician had the intention to start with apixaban treatment. In the Leiden University Medical Center, the treatment protocol recommended patients to be treated with apixaban 10 mg twice daily for 1 week after which apixaban 5 mg twice a day was initiated. In the Haga Teaching Hospital, the treatment protocol recommended patients to be initially treated with approximately 1 week of therapeutic weight based low-molecular-weight heparin (LMWH) after which apixaban 5 mg twice daily was given. Protocol deviations in both hospitals were common, truly reflected practice-based medicine. Thus, the decision which of the two treatment regimens was initiated, depended on the discretion of the treating physician.

Patients who completed at least 3 months of anticoagulant therapy or met a study end-point in that period were included in this current analysis. Follow-up data were retrieved from the patient chart. Due to the retrospective study design, the need for informed consent was waived by the institutional review boards of both hospitals.

**Aims and Outcomes**

The primary aim of this study was to evaluate the efficacy and safety of apixaban in VTE patients in daily practice. The primary efficacy outcome was recurrent VTE and all-cause mortality during a 3-month follow-up period after index VTE. The primary safety outcome was the 3-month incidence of major bleeding.

Secondary outcomes in this study were (1) the reported side effects of apixaban as noted by the treating physician in the patient chart and (2) the primary outcomes in the first week of treatment.

**Definitions**

Recurrent VTE was defined as a new intraluminal filling defect on computed tomographic pulmonary angiography, confirmation of a new PE at autopsy, or a new intraluminal filling defect on computed tomographic angiography in other venous beds. Recurrent lower extremity DVT was defined as new non-compressibility by ultrasonography or as an increase in vein diameter under maximal compression, as measured in the abnormal venous segment, indicating an increase in thrombus diameter (≥4 mm), or by a positive signal on magnetic resonance direct thrombus imaging (DTI) indicative of fresh thrombus in the proximal veins of the leg.13–15

Major bleeding was defined according to the International Society of Thrombosis and Haemostasis (ISTH) criteria as any bleeding resulting in death, symptomatic bleeding in a critical organ (intracranial, intraspinal, intraocular, retroperitoneal, intra-articular and pericardial bleeding and muscle bleeding resulting in compartment syndrome) or symptomatic bleeding resulting in a decrease in the hemoglobin concentration of at least 2 g/dL or resulting in the transfusion of at least two packs of red blood cells.16

In case of death, information was obtained from the hospital records. VTE-related mortality was defined as death within 7 days of PE diagnosis, PE confirmed as cause of death during autopsy, or sudden unexpected death with no other explanation. All events were adjudicated by two independent experts who were unaware of the initial management decision. Any disagreement between the two independent experts was resolved by a third expert.

**Statistical Analysis**

For the presentation of the baseline characteristics, categorical data are presented as percentages or as proportion and continuous variables as means with standard deviation (SD). The main outcomes of the study are expressed by frequency and proportion with corresponding 95% confidence interval (95% CI). All adverse events were included in the primary analysis. The secondary outcome-reported side effect is provided as frequencies and proportion. SPSS version 25.0.0 (SPSS, IBM, Armonk, NY) was used to perform all analyses.

**Results**

**Study Patients**

Between January 2016 and December 2018, 671 consecutive patients were diagnosed with VTE and treated with apixaban, of whom 300 (45%) had DVT and 371 (55%) had PE with or without DVT. The baseline demographic and clinical characteristics of all 671 patients are summarized in ▶Table 1. Their
mean age was 60 years (SD: 16), 48% was female and 6.3% had active malignancy at time of diagnosis. The median weight in this cohort was 85 kg (SD: 18.6) with 84 patients (13%) having a weight above 100kg. Renal insufficiency (creatinine clearance < 50 mL/min) was present in 60 patients (8.9%). Thirteen patients had severe renal insufficiency, a creatinine clearance estimated glomerular filtration rate < 30 mL/min (1.9%). The vast majority of the patients (74%) were treated as outpatient after initial index VTE; this was 93% for those with DVT and 58% for those with PE with or without DVT. For the patients treated initially in hospital, the median admission duration was 5.0 days (interquartile range 7).

Outcomes
During 3 months follow-up, two patients experienced a recurrent VTE (0.30%; 95% CI: 0.08–1.1; Table 2). A 71-year-old patient had progressive iliac vein thrombosis, 3 days after diagnosis of a DVT of the femoral vein and start of apixaban in the presence of a myelodysplastic syndrome. Another 49-year-old patient was diagnosed with symptomatic segmental PE, 1 month after initial DVT diagnosis, in the presence of a progressive stage IV nonsmall cell lung carcinoma.

A total of 12 patients (1.8%; 95% CI: 1.0–2.9) experienced major bleeding. The details of the major bleeding, its management, and outcome are provided in Table 3. Of the 12 major bleedings, three occurred during the first week, including two major bleedings during LMWH therapy. One possible intracranial bleeding under LMWH was fatal; another major bleeding occurred in the presence of thrombocytopenia (platelet count 23 × 10^9/L); three patients (25%) had a malignancy.

Eleven patients (1.6%; 95% CI: 0.9–2.9) died during the 3 months follow-up (Table 4). One patient on apixaban died of the index PE within 24 hours of the initial PE diagnosis. Seven patients (64%) had active malignancy at time of death and all died after initiation of palliative care at home or hospice because of metastasized end-stage disease. One patient died due to a possible intracerebral bleed; apixaban was already stopped and LMWH had been started.

Secondary Outcomes
The most frequent reported side effects of apixaban were headache (2.5%) and abdominal discomfort (2.4%). The following less frequent side effects were reported by the treating physician: nausea (0.9%), rash/hypersensitivity (0.4%), itching (0.8%), hair loss (0.3%), paraesthesia (0.3%), and dizziness (0.3%; Table 5) causing switch to an alternative

### Table 1 Baseline characteristics of patients with VTE treated with apixaban

<table>
<thead>
<tr>
<th>Demographics</th>
<th>n = 671</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>60 (16)</td>
</tr>
<tr>
<td>Male sex, no (%)</td>
<td>347 (51.7)</td>
</tr>
<tr>
<td>Weight in kg, mean (SD)</td>
<td>84.7 (18.6)</td>
</tr>
<tr>
<td>&lt; 60 kg—no (%)</td>
<td>26 (3.9)</td>
</tr>
<tr>
<td>60–100 kg—no (%)</td>
<td>354 (53)</td>
</tr>
<tr>
<td>&gt; 100 kg—no (%)</td>
<td>84 (13)</td>
</tr>
<tr>
<td>Missing—no (%)</td>
<td>207 (31)</td>
</tr>
<tr>
<td>Body mass index, mean (SD)</td>
<td>27.3 (5.1)</td>
</tr>
<tr>
<td>Creatinine clearance—no (%)</td>
<td>41 (6.1)</td>
</tr>
<tr>
<td>&lt; 30 mL/min</td>
<td>13 (1.9)</td>
</tr>
<tr>
<td>30–50 mL/min</td>
<td>47 (7)</td>
</tr>
<tr>
<td>50–80 mL/min</td>
<td>239 (36)</td>
</tr>
<tr>
<td>&gt; 80 mL/min</td>
<td>319 (48)</td>
</tr>
<tr>
<td>Missing—no (%)</td>
<td>53 (8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VTE risk factors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous venous thromboembolism—no (%)</td>
<td>145 (22)</td>
</tr>
<tr>
<td>COPD—no (%)</td>
<td>65 (9.7)</td>
</tr>
<tr>
<td>Heart failure—no (%)</td>
<td>21 (3.1)</td>
</tr>
<tr>
<td>Estrogen use—no (%)</td>
<td>67 (10)</td>
</tr>
<tr>
<td>Immobilization—no (%)</td>
<td>174 (26)</td>
</tr>
<tr>
<td>Active malignancy no.—no (%)</td>
<td>42 (6.3)</td>
</tr>
<tr>
<td>Recurrent or metastatic cancer—no (%)</td>
<td>21 (3.1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VTE presentation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualifying diagnosis of VTE—no (%)</td>
<td>371 (55)</td>
</tr>
<tr>
<td>PE with or without DVT</td>
<td>300 (45)</td>
</tr>
<tr>
<td>Incidental PE no. (%)</td>
<td>16 (2.4)</td>
</tr>
<tr>
<td>Extent of qualifying PE no. (%)</td>
<td>37/371 (10)</td>
</tr>
<tr>
<td>Subsegmental</td>
<td>37/371 (10)</td>
</tr>
<tr>
<td>Segmental</td>
<td>29/371 (44)</td>
</tr>
<tr>
<td>Central</td>
<td>165/371 (44)</td>
</tr>
<tr>
<td>Could not be assessed</td>
<td>7/371 (2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Outpatient treatment</td>
<td>496 (74)</td>
</tr>
<tr>
<td>Readmissions</td>
<td>121 (18)</td>
</tr>
<tr>
<td>Apixaban without prior anticoagulant treatment</td>
<td>348 (52)</td>
</tr>
<tr>
<td>Apixaban with prior LMWH usage</td>
<td>323 (48)</td>
</tr>
</tbody>
</table>

Abbreviation: COPD, chronic obstructive pulmonary disease; DVT, deep-vein thrombosis; LMWH, low-molecular-weight heparin; PE, pulmonary embolism; SD, standard deviation; VTE, venous thromboembolism.

### Table 2 VTE-related adverse events of patients treated with apixaban

<table>
<thead>
<tr>
<th>Event</th>
<th>Number</th>
<th>Incidence</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Overall mortality</td>
<td>11</td>
<td>1.6</td>
<td>0.9–2.9</td>
</tr>
<tr>
<td>2. Major bleeding</td>
<td>12</td>
<td>1.8</td>
<td>1.0–3.2</td>
</tr>
<tr>
<td>3. Recurrent VTE</td>
<td>2</td>
<td>0.30</td>
<td>0.08–1.1</td>
</tr>
</tbody>
</table>

Abbreviations: VTE, venous thromboembolism, 95% CI, 95% confidence interval.
### Table 3 Detailed information of major bleeding

<table>
<thead>
<tr>
<th>Patient</th>
<th>Sex</th>
<th>Age</th>
<th>Initial event</th>
<th>Time to adverse event</th>
<th>Major bleeding specified</th>
<th>Management and outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td>F</td>
<td>74</td>
<td>PE</td>
<td>2 days</td>
<td>Decrease in the hemoglobin concentration &gt; 2 g/dL</td>
<td>Management: Conservative. LMWH treatment was continued twice daily in therapeutic dosage followed by apixaban. Outcome: Resolved without sequelae.</td>
</tr>
<tr>
<td>No. 2</td>
<td>F</td>
<td>83</td>
<td>PE</td>
<td>5 days</td>
<td>Small traumatic intracerebral bleeding after a fall in the first week with LMWH treatment</td>
<td>Management: anticoagulant treatment was ceased. Temporary administration of prophylactic doses of LMWH. Apixaban was started 7 days later. Outcome: Resolved without sequelae.</td>
</tr>
<tr>
<td>No. 3</td>
<td>M</td>
<td>61</td>
<td>PE</td>
<td>7 days</td>
<td>Gastrointestinal bleeding resulting in decrease in the hemoglobin concentration &gt; 2 g/dL, colonoscopy showed post colon polypectomy bleeding. Received infusion of thrombolytic drugs because of high-risk PE in beginning of admission 7 days prior</td>
<td>Management: administration of three packed red blood cells and 2000 IU prothrombin complex concentrate. Apixaban was temporarily stopped with temporary administration of prophylactic dosage of LMWH. Apixaban was restarted after successful clip closure of the post polypectomy bleed. Outcome: apixaban was restarted 2 days after bleeding, patient was discharged 3 days after bleeding.</td>
</tr>
<tr>
<td>No. 4</td>
<td>M</td>
<td>69</td>
<td>PE</td>
<td>8 days</td>
<td>Macroscopic hematuria resulting in decrease in the hemoglobin concentration &gt; 2 g/dL after Millin prostatectomy</td>
<td>Management was started with operative evacuation of clots and continuous irrigating of the bladder via an indwelling catheter. Apixaban was switched to LMWH in a lower therapeutic dosage. After 26 days apixaban was restarted in the outpatient clinic. Outcome: Resolved without sequelae.</td>
</tr>
<tr>
<td>No. 5</td>
<td>M</td>
<td>71</td>
<td>DVT</td>
<td>14 days</td>
<td>Bleeding in pancreas from pancreatic pseudoaneurysm</td>
<td>Management: coiling, anticoagulation was temporary stopped, temporary prophylactic dosage of LMWH was administered. Outcome: discharged 1 day after coiling with the restart of anticoagulant treatment.</td>
</tr>
<tr>
<td>No. 6</td>
<td>F</td>
<td>46</td>
<td>DVT</td>
<td>21 days</td>
<td>Abnormal menstrual bleeding resulting in decrease in the hemoglobin concentration &gt; 2 g/dL after stopping oral contraceptives</td>
<td>Management: oral contraceptives restarted, tranexamic acid was refused by patient. Outcome: Resolved without sequelae, apixaban was continued during the complete follow-up.</td>
</tr>
<tr>
<td>No. 7</td>
<td>F</td>
<td>37</td>
<td>PE</td>
<td>37 days</td>
<td>Abnormal menstrual bleeding resulting in decrease in the hemoglobin concentration &gt; 2 g/dL</td>
<td>Management: administration of tranexamic acid and iron infusion. Due to extent of bleeding, embolization of the uterine artery was necessary. Outcome: Resolved without sequelae, after three days of cessation on anticoagulants, therapeutic dosages of LMWH were administered for 2 months, after which apixaban was continued.</td>
</tr>
<tr>
<td>No. 8</td>
<td>M</td>
<td>62</td>
<td>DVT</td>
<td>42 days</td>
<td>A decrease in the hemoglobin concentration &gt; 2 g/dL requiring transfusion because of gastrointestinal bleeding on due to diffuse vulnerable mucous membrane seen on endoscopic examination, post alloegenic bone marrow transplantation due to myelodysplastic syndrome. (platelet count 23 × 109/L)</td>
<td>Management: thrombocyte transfusion, start of proton pump inhibition intravenously. Outcome: no gastrointestinal bleed was objectified after 3 days of conservative therapy; anticoagulant treatment was continued.</td>
</tr>
<tr>
<td>No. 9</td>
<td>M</td>
<td>82</td>
<td>PE</td>
<td>55 days</td>
<td>Progressive subdural hematoma and progressive subdural hygroma (both present before apixaban was started)</td>
<td>Management: anticoagulation was discontinued indefinitely. Outcome: after initial progression of subdural fluid collection resulting in unilateral paresis of the arm, dexamethasone was administered, resulting in partial clinical recovery and regression of the fluid collection on CT.</td>
</tr>
</tbody>
</table>
### Table 3 (Continued)

<table>
<thead>
<tr>
<th>Patient</th>
<th>Sex</th>
<th>Age</th>
<th>Initial event</th>
<th>Time to adverse event</th>
<th>Major bleeding specified</th>
<th>Management and outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 10</td>
<td>F</td>
<td>76</td>
<td>PE</td>
<td>56 days</td>
<td>Gastrointestinal bleeding resulting in decrease in the hemoglobin concentration &gt; 2 g/dL and transfusion required; clinical diagnosis diverticular bleeding, endoscopic examination showed no focus</td>
<td>Management: administration of intravenous tranexamic acid and 3900 IU prothrombin complex concentrate, anticoagulation was temporary stopped Outcome: resolved without sequelae after an admission of 3 days; apixaban was restarted the day after discharge</td>
</tr>
<tr>
<td>No. 11</td>
<td>F</td>
<td>57</td>
<td>PE</td>
<td>75 days</td>
<td>Ruptured spleen in patients with diffuse large B cell lymphoma with splenic localizations. Also, a large amount of hemorrhagic pleural effusion was drained by thoracentesis</td>
<td>Management: anticoagulation was discontinued indefinitely Outcome: patient also received first line of therapy for DLBCL and was discharged after an admission of 45 days</td>
</tr>
<tr>
<td>No. 12</td>
<td>M</td>
<td>59</td>
<td>DVT</td>
<td>81 days</td>
<td>Possible intracerebral bleeding in presence of progressive esophageal cancer while treated with LMWH. Symptoms of headache, nausea, and vision loss were present. Patient refused further treatment and decided to receive end-of-life care at home</td>
<td>Management: palliative treatment Outcome: patient died 5 days later</td>
</tr>
</tbody>
</table>

Abbreviations: CT, computed tomography; DLBCL, diffuse large B cell lymphoma; F, female; IU, international units; LMWH, light-molecular-weight heparin; M, male.

### Table 4 Detailed information of deaths

<table>
<thead>
<tr>
<th>Patient</th>
<th>Sex</th>
<th>Age</th>
<th>Time to event</th>
<th>Specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1 F</td>
<td>93</td>
<td>0 days</td>
<td>Patient presented at ER with stridor and hypoxia. CT showed an incidental subsegmental PE. One single administration of apixaban was ordered. She died several hours after presentation with stridor, severe hypoxia, and laryngeal spasms. At autopsy, no good explanation was found for the upper airway narrowing as cause of death</td>
<td></td>
</tr>
<tr>
<td>No. 2 F</td>
<td>81</td>
<td>1 day</td>
<td>Patient using apixaban died of fatal PE, occurring 1 day after initial PE diagnosis with symptoms of progressive oxygen requirement and signs of exhaustion. Resection of a meningioma was the initial reason for admission, which was complicated by a pneumonia and acute PE. Due to severe comorbidity, that is, advanced age with frailty, severe emphysema, and a refractory delirium, palliative treatment was started</td>
<td></td>
</tr>
<tr>
<td>No. 3 M</td>
<td>87</td>
<td>10 days</td>
<td>Patient died due to progressive cerebral ischemia; on admission also an incidental segmental PE was diagnosed. Due to neurological deterioration and advanced age, a palliative treatment was started</td>
<td></td>
</tr>
<tr>
<td>No. 4 M</td>
<td>46</td>
<td>14 days</td>
<td>Patient was diagnosed with incidental PE in presence of a progressive stage IV NSCLC with obstruction of the right upper lobe bronchus, lymphangitis carcinomatosis, and pleural fluid. One day after initiation of palliative treatment, patient died</td>
<td></td>
</tr>
<tr>
<td>No. 5 M</td>
<td>71</td>
<td>26 days</td>
<td>Patient died in a nursing home after neurologic deterioration due to progressive hydrocephalus. Initial admission was because of a subarachnoid bleeding treated with coiling of its aneurysm and extraventricular drainage. During hospital admission PE was diagnosed. Palliative treatment was initiated after neurological deterioration</td>
<td></td>
</tr>
<tr>
<td>No. 6 M</td>
<td>49</td>
<td>46 days</td>
<td>Patient died at home after initiation of palliative treatment. Multiple cerebral ischemic events occurred in the presence of a progressive stadium IV NSCLC resulting in a severe thrombophilic condition. Patient was also diagnosed with recurrent VTE during the 3-month follow-up</td>
<td></td>
</tr>
<tr>
<td>No. 7 M</td>
<td>57</td>
<td>56 days</td>
<td>Palliative treatment was initiated after admission of a subtotal ileus in the presence of metastasized gastric cancer with peritonitis carcinomatosis. Care was provided by the general practitioner</td>
<td></td>
</tr>
<tr>
<td>No. 8 F</td>
<td>64</td>
<td>74 days</td>
<td>Died at home after initiation of palliative treatment due to advanced stage NSCLC with bone and myogenic metastasis with progressive pleural carcinomatosis</td>
<td></td>
</tr>
<tr>
<td>No. 9 M</td>
<td>62</td>
<td>83 days</td>
<td>Patient died because of infectious complications after a hematopoietic stem cell transplantation due to myelodysplastic syndrome. Patient was admitted because of respiratory</td>
<td></td>
</tr>
</tbody>
</table>
anticoagulant in 13% of all 53 patients with side effects. All adverse events within the first week of anticoagulant treatment strategies are provided in Table 6.

**Discussion**

In this practice-based study, we observed a lower rate of recurrent VTE (0.3% during 3 months) in patients treated with apixaban than that observed in the phase 3 AMPLIFY clinical trial (2.3% during 6 months). In contrast, the incidence of major bleeding (1.8% during 3 months) was higher than in the apixaban-treated patients in the AMPLIFY study (0.6% during 6-month follow-up).

The low rate of recurrent VTE could be explained by the difference in the follow-up duration in the phase 3 AMPLIFY clinical trial, which was twice as long. Moreover, a considerable percentage of recurrent VTE was adjudicated as death for which PE could not be ruled out. We therefore think VTE recurrence rates in both studies are likely comparable. Overall, the baseline characteristics in our cohort were comparable to those of the AMPLIFY study except that the proportion of patients included with a DVT was higher in the AMPLIFY study compared with 45% in this cohort. Moreover, more than half (52%) of our patients started apixaban without prior anticoagulant treatment, while this rate was 13% in the AMPLIFY study patients. Notably, the proportion of patients with initial LMWH treatment decreased over time, as experience and knowledge with apixaban treatment increased during the observation period.

The most notable difference of this analysis compared with the AMPLIFY study was the incidence of major bleeding. Taking a closer look at the patients who experienced a major bleeding episode elucidates the difference between our practice-based study and the phase 3 AMPLIFY study. First of all, two patients suffered from a hematological disease, with one being shortly after a hematopoietic stem cell transplantation, at time of bleeding. Overall, three out of 12 patients (25%) who experienced major bleeding had an active malignancy. Treatment of cancer-associated VTE is not only challenging due to a higher risk of recurrent VTE and mortality but also because of higher incidences of major bleeding. The added value of DOAC therapy in patients with cancer-associated thrombosis has already been established with the publication of the SELECT-D3 and Hokusai VTE cancer trials, with consideration for the risk of bleeding in certain tumor types (e.g., gastrointestinal, urogenital). International guidelines currently advise to consider the use of DOACs in cancer-associated thrombosis with caveats for these gastrointestinal and urogenital tumors. In this respect, the fact that DOACs were sometimes prescribed in patients with cancer-associated VTE in this cohort reflects anticoagulant therapy in current daily practice. Second, in two patients bleeding occurred shortly after intervention; one patient already had a subdural fluid collection and one patient experienced bleeding within a week after prior treatment of thrombolytic therapy. These patients would...
have been excluded in phase 3 trials as they dictate strict in-
and exclusion criteria. We observed two heavy menstrual bleedings in this
cohort. Treatment with factor Xa inhibitors is indeed asso-
ciated with an increased risk of abnormal uterine bleeding,
particularly heavy menstrual bleeding in premenopausal
women when compared with treatment with VKA. The
observation that these women were admitted because of
heavy menstrual bleeding, although it was not specifically
monitored in this cohort, underlines the relevance of moni-
toring and counseling the risk of heavy menstrual bleeding
in premenopausal women after initiating DOAC therapy.

Interestingly, in the management of major bleeding, pro-
thrombin complex concentrate (PCC) was only used twice in
patients with gastrointestinal bleeding, while all other
patients with major bleeding were treated conservatively
by only stopping the apixaban. This observation that most
major bleeding events were managed conservatively, with-
out the use of PCC, was also observed in the Dresden NOAC
registry (PCC administered in 6.7% of all major bleeding
events). Overall, the rate of major bleeding in our cohort is
comparable to rates of other practice-based cohorts in
current literature. A systematic review including five large
observational cohorts showed a 0.6 to 3.6% 3 months major
bleeding rate in patients treated with apixaban for acute
VTE. Same proportions of major bleeding associated with
DOAC therapy (3.3% during a mean follow-up of 85 days)
were observed in a large practice-based multicenter, popu-
lation study, although most DOAC users in this study used
rivaroxaban.

The main limitation is the presence of selection bias as we
do not know in how many patients (and why) another
anticoagulant strategy than apixaban was chosen. Of note,
apixaban was the first choice in anticoagulant therapy in
both hospital protocols for VTE management. Therefore, we
consider our results representative for daily practice since
patients from both an academic and a nonacademic teaching
hospital were studied and we observed rates of adverse
events and mortality comparable to the published literature.
Two of the major bleedings occurred on LMWH treatment in
the first week of anticoagulant treatment, while the treating
physician continued with apixaban treatment after the
initial LMWH course. According to the intention to treat
principle, we included those adverse events in the final
analysis, which may have led to an overestimation of the
apixaban associated rate of major bleeding. Strengths in-
clude the completeness of follow-up and the lack of exclusion
criteria compared with clinical trials. Moreover, all outcomes
were adjudicated by independent experts and we could
provide detailed data on management and outcome for
each adverse event.

In conclusion, apixaban yielded a low incidence of recurrent
VTE in our large practice-based patient cohort. The incidence
of major bleeding was, however, higher than in the AMPLIFY
study, reflecting the importance of daily practice evaluation
and the fact that results from phase III clinical studies cannot
be directly extrapolated toward daily practice.

Essentials
- In VTE treatment, phase 3 studies have shown comparabil-
bly efficacious DOACs and VKA, with a better bleeding
profile.
- Both efficacy and bleeding rates may be underestimated
in phase 3 trials because patients at higher risk of bleeding
are usually excluded.
- In this practice-based cohort, the incidence of major
bleeding was higher than in the AMPLIFY study patients.
- Results from phase III clinical studies cannot be directly
extrapolated toward daily practice.

Authors’ Contributions
S.V.H. contributed to concept and design of the study,
analyzed and interpreted the data, and drafted the
manuscript. M.V.H. contributed to concept and design
of the study, analyzed and interpreted the data, reviewed
the manuscript, and provided important intellectual
content. J.C.J.E. reviewed the manuscript and provided
important intellectual content. J.F. reviewed the manu-
script and provided important intellectual content. W.J.E.
S. analyzed and interpreted the data and provided im-
portant intellectual content. A.T.A.M. reviewed the manu-
script and provided important intellectual content. F.A.
K. reviewed the manuscript, contributed to concept and
design of the study, and analyzed and interpreted the
data.

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Effectiveness and Safety of Apixaban for VTE in Daily Practice


