A 77-year-old male with subacute right foot ischemia was treated with endovascular therapy to relieve total thrombosis of the pedal arch extending from the dorsalis pedis of the anterior tibial artery into the posterior tibial artery, plantar segment. Because the procedure was only partially successful, rivaroxaban was used for thrombolytic treatment resulting in improvement of the patient’s ischemic pain and avoidance of gangrenous progression and surgical amputation. This is the first report describing successful recanalization of pedal arch arterial thrombosis using rivaroxaban in a patient after suboptimal results of endovascular therapy.

Key Words: Arterial thrombosis • Endovascular therapy • Rivaroxaban

INTRODUCTION

The primary trigger for arterial thrombosis is the rupture of an atherosclerotic plaque, causing complete or partial vessel occlusion. In the initial stage of plaque rupture, platelets are rapidly recruited to the site, followed by activation of coagulation cascade resulting in the formation of arterial thrombus. Although antiplatelet agents are commonly used to prevent the incidence of arterial thrombosis, coagulation is clearly activated after plaque rupture, which provides a mechanistic rationale for anticoagulation therapy.

Clinical evidence has shown that the combination of anticoagulant and antiplatelet therapy is more effective than either treatment alone. Traditional anticoagulants are associated with limitations such as the requirement for routine coagulation monitoring and dose adjustment with vitamin K antagonists. In recent years, some of the new oral anticoagulants (NOAC) (such as direct factor Xa inhibitors and direct thrombin inhibitors) have undergone extensive evaluation for the prevention and treatment of thromboembolic disorders. However, neither clinical studies nor case reports on the successful treatment of arterial thrombosis by NOACs are currently available in the literature.

Rivaroxaban (Xarelto) is an oral factor Xa inhibitor that was approved by the Food and Drug Administration (FDA) in 2011 to treat nonvalvular atrial fibrillation. This report describes successful recanalization of pedal arch arterial thrombosis using rivaroxaban in a patient after suboptimal results of endovascular therapy.

CASE REPORT

A 77-year-old male, with a history of diabetes mellitus type 2 and hypertension, presented to our hospital with right foot pain for 3 weeks and dry gangrene involving the 1st and 2nd digits of his right foot. He was admitted with a diagnosis of subacute limb ischemia. Diagnostic angiography revealed total occlusion of the
pedal arch of the right foot extending from the dorsalis pedis of the anterior tibial artery into the posterior tibial artery, plantar segment (Figure 1A-E). Therefore, endovascular therapy was planned to restore perfusion to the pedal arch of the right foot.

The right common femoral artery was punctured and a 6 Fr. RAABE (Cook, Bloomington, IN, USA) sheath was inserted. A 0.014 in, 300 cm, Choice PT2 guidewire (Boston Scientific) was used to cross the lesion from the anterior tibial artery to the posterior tibial artery. Thrombus aspiration was attempted without success using a 6 Fr monorail aspiration catheter (Thrombuster/Kaneka, Osaka, Japan). Thus, a 2.0 x 80 mm Bantam balloon (ClearStream, Wexford, Ireland) was used to dilate the lesion to 10 atm for 3 minutes (Figure 2A-B). The final angiogram revealed sluggish blood flow through the entire pedal arch between the anterior and posterior tibial arteries without visible branches (Figure 2C).

After obtaining informed consent, self-paid rivaroxaban 15 mg once-daily therapy was begun the day after endovascular therapy as the patient’s ischemic pain was persistent and required intravenous morphine for pain control. His ischemic pain improved gradually after rivaroxaban therapy on oral acetaminophen only. Because his wound was not infected and there was no further progression of gangrene, a plastic surgeon consultation and follow-up at our outpatient clinic was arranged after discharge, which occurred 7 days after initiation of rivaroxaban treatment. After 3 months of aspirin and rivaroxaban treatment, recanalization of the patient’s metatarsal arteries was noted on follow-up angiography (Figure 2D). Because the tissue proximal to the gangrenous tissue was well-perfused, maximum tissue preservation could be achieved by allowing auto-

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**Figure 1.** Baseline angiography shows patent right anterior tibial (AT) and posterior tibial (PT) arteries (A-C), but total occlusion (red arrows) within the pedal arch of the right foot extending from the dorsalis pedis (DP) of the AT artery into the PT plantar segment, shown from different angle views on lateral (D) and anteroposterior views (E).
amputation of the gangrenous portions of the 1st and 2nd digits of his right foot.

**DISCUSSION**

To the best of our knowledge, this is the first documented report involving arterial thrombosis resolution after endovascular therapy and rivaroxaban treatment.

The pedal arch is defined as the area between the anterior and posterior circulations of the foot, composed of the deep perforating branches of the dorsal artery and the lateral plantar arteries. Optimal revascularization of the pedal arch is needed in patients with foot ulcers or ischemic changes. For arterial thrombosis, treatment consists of thrombectomy (catheter or surgical), thrombolysis, or bypass surgery. This type of treatment is based on the duration and severity of ischemia, the extent or location of the thrombus, and the general medical condition of the patient.

The difficulties encountered in this case included the patient’s challenging foot anatomy as his vessels were of small caliber with large angulation causing difficulties in advancing wires and endovascular devices. In addition, the arterial thrombosis was at least 3 weeks old. Thus, the thrombi were already organized, limiting success during catheter-based thrombolysis and/or thrombectomy, or surgical thrombectomy. After advancing a wire through the pedal arch and performing balloon angioplasty, the flow to the pedal arch was restored; however, the branches of the arch were still thrombotic. Thus, following the procedure, the patient’s ischemic pain was not markedly improved.

Rivaroxaban (Xarelto) is a new anticoagulant that was approved by the FDA in 2011 for stroke and systemic embolism prophylaxis in patients with nonvalvular atrial fibrillation. Rivaroxaban is also indicated for treatment and prevention of pulmonary embolism and deep vein thrombosis. Several characteristics have made rivaroxaban an attractive alternative to warfarin including its once daily dosing and the fact that it obviates the need for monitoring the international normalized ratio, lowering the risk of intracranial hemorrhage and fatal bleeding compared with warfarin.

Because the primary mechanisms for arterial thrombosis are from rupture of plaque inducing platelet aggregation and following activation of coagulation cascades, in arterial thrombotic events, drugs that reduce the growth of a thrombus including antiplatelet and anticoagulant agents should be administered. According to the suboptimal angiogram after endovascular therapy for the present case, sluggish blood flow and thrombotic branches were noted. Therefore, in addition of antiplatelet and anticoagulant therapy, further thrombolytic therapy may be needed. Besides having an anticoagulant effect, previously published studies reported that rivaroxaban could increase the permeability and degradability of the clot, thus promoting clot lysis. Considering the advantage of anticoagulant and thrombolytic effects, rivaroxaban was off-label used for the patient suffering from arterial thrombosis. Although clinical studies involving treatment of arterial thrombosis by rivaroxaban are not available, rivaroxaban’s anti thrombolic efficacy has been demonstrated in various animal models of arterial thrombosis. In our case, after using rivaroxaban treatment, the patient’s ischemic
pain improved without progression of gangrene and he was discharged 7 days after admission, and his foot was saved from amputation. Therefore, this case report showed the potential benefit of rivaroxaban in resolving arterial thrombosis. Future clinical studies on the thrombolytic effects of NOACs (including rivaroxaban) are thus warranted.

In conclusion, rivaroxaban is a new class of anticoagulant with several advantages to traditional anticoagulants. We report the first case of arterial thrombosis resolution after endovascular therapy and rivaroxaban treatment.

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CONFLICT OF INTEREST STATEMENT

All authors have no conflicts of interest to declare.

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