

## Endovascular treatment of upper extremity ischemia due to radiation-induced arteritis

### Radyasyon arteritine bağlı üst ekstremitte iskemisinin endovasküler tedavisi

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**Summary**–Symptomatic occlusion of the peripheral arteries due to radiation-induced arteritis (RIA) is an extremely rare condition. Patients generally present with the symptoms of ischemic claudication months or years after radiotherapy. Treatment options for symptomatic patients include surgical or endovascular interventions. Although success rate of percutaneous angioplasty in RIA is lower than in atherosclerotic disease, there are several case reports in the literature to demonstrate successful percutaneous angioplasty for RIA. In this report, we presented a case with right upper extremity occlusion due to RIA treated by percutaneous angioplasty successfully.

**Özet**–Radyasyona bağlı arterit (RIA) nedeniyle periferik arterlerin semptomatik tıkanması son derece nadir bir durumdur. Hastalar genellikle radyoterapiden aylar veya yıllar sonra iskemik klaudikasyon semptomları ile başvururlar. Semptomatik hastalar için tedavi seçenekleri cerrahi veya endovasküler müdahaleleri içerir. RIA’da perkütan anjiyoplastinin başarı oranı aterosklerotik hastalığa göre daha düşük olmasına rağmen, literatürde RIA için başarılı perkütan anjiyoplastiyi gösteren az sayıda vaka raporu vardır. Bu raporda, perkütan anjiyoplasti ile başarılı bir şekilde tedavi edilen RIA’ya bağlı sağ üst ekstremitte tıkanıklığı olan bir olguyu sunduk.

Symptomatic occlusion of the axillary and subclavian arteries due to radiation-induced arteritis (RIA) is an extremely rare condition.<sup>[1]</sup> Patients generally present with the symptoms of ischemic claudication of upper extremity months or years after radiotherapy.<sup>[2]</sup> Treatment options for symptomatic patients include surgical or endovascular interventions. The success rate of percutaneous angioplasty in RIA is lower than in atherosclerotic disease because of severe intimal fibrosis and thickening and long-segment involvement.<sup>[3]</sup> However, there are several case reports in the literature to demonstrate successful percutaneous angioplasty for RIA.<sup>[4]</sup> In this report, we presented a case with right upper extremity occlusion due to RIA treated by percutaneous angioplasty successfully.

and coolness exacerbating with movement. Her vitals were normal, electrocardiography was normal sinus rhythm, and diminished pulse and pain with the repetitive movement were detected in the right upper extremity. Her medical history was unremarkable, except the previous radiotherapy and radical mastectomy due to breast cancer in the right side 5 years ago; curative treatment was provided without recurrence. External beam radiotherapy with 100 Gy dose was implemented to the right thorax. Doppler examination revealed occlusion of the axillary artery with the diminished flow in the forearm arteries. Conventional angiography has been implemented as the next procedure, and occlusion of the axillary artery with a weak collateral blood flow was seen (Figure 1, Video 1\*). Balloon angioplasty was performed with 5 × 150 mm (Mustang 0.035” Balloon-Dilatation-Catheter-Boston Scientific) balloon (Figure 1B, Video 2\*). After the balloon angioplasty, restoration of blood flow was observed, and follow-up was decided for the short linear dissection because of the absence of

#### CASE REPORT

A 47-years-old female patient was admitted to the outpatient cardiology clinic due to the right arm pain



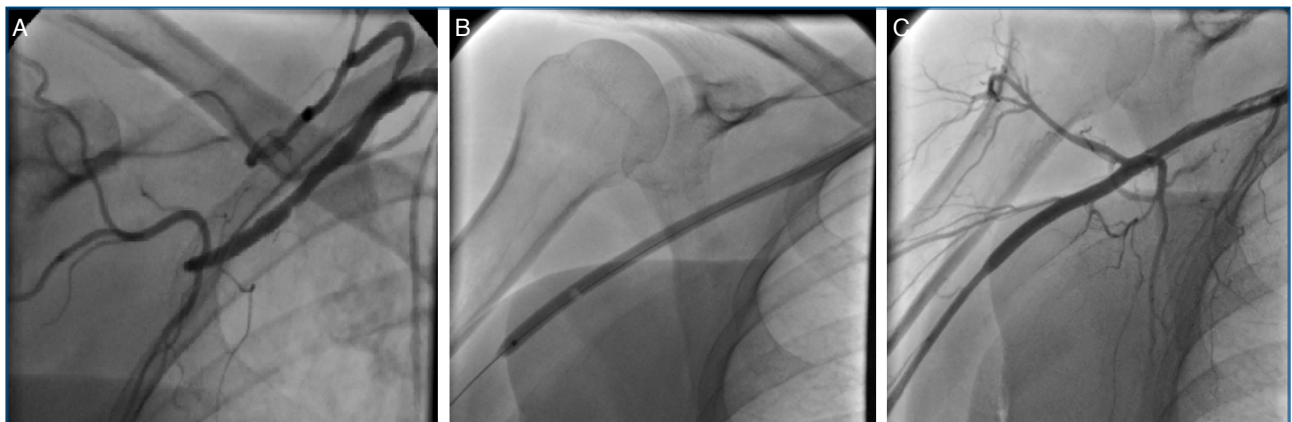
flow limitation (Figure 1C, Video 3\*). Pain and pulselessness recurred 24 hours after the procedure, angiography was repeated, and the absence of the axillary blood flow was detected (Figure 2A, Video 4\*). After the balloon dilatation with 5.0 × 60 mm (Mustang 0.035" Balloon-Dilatation-Catheter-Boston Scientific), 6.0 × 100 mm, and 6.0 × 17 mm self-expandable stents (Epic, Boston Scientific Corporation, Naick, MA, USA) were implanted successfully (Figure 2B, Video 5\*). Optimal blood flow was provided (Figure 2C, Video 6\*), and the patient was discharged with clopidogrel 75 mg 1 × 1 p.o. and rivaroxaban 15 mg 1 × 1 p.o. after 2 days' follow-up with the complete resolution of symptoms. Physical examination, family history, and laboratory findings (C-reactive protein, anti nuclear antibody profile, erythrocyte-sedimentation rate, etc.) were negative for inflammatory or

rheumatologic diseases. The patient denied any other

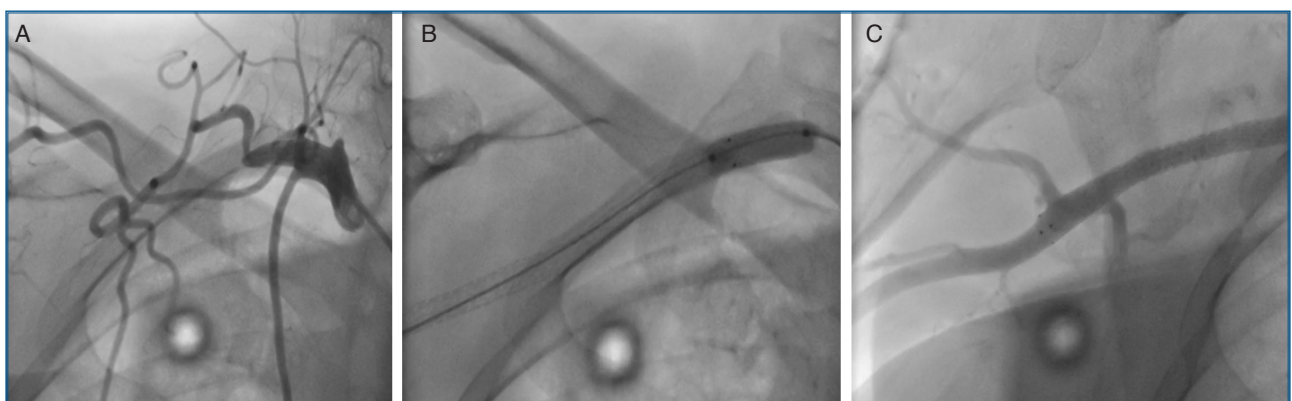
**Abbreviations:**

RIA Radiation-induced arteritis

symptoms such as arthralgia, cutaneous lesions, and constitutional symptoms, which would be associated with rheumatologic diseases. Consultation with rheumatology department was done, and rheumatologic etiology was not considered because symptoms, physical examination, and laboratory markers were not suggestive. Coronary angiography was done during the first procedure and revealed normal epicardial coronary arteries. Furthermore, the patient did not have any risk factors for atherosclerosis such as diabetes mellitus, smoking, hyperlipidemia, family history, etc. Carotid artery Doppler examination was also normal. For all these reasons, any atherosclerotic process or vasculitis was not considered. Thoracic



**Figure 1.** Occlusion of the axillary artery (A). Balloon angioplasty was performed with 5 × 150 mm (Mustang 0.035" Balloon-Dilatation-Catheter-Boston Scientific) balloon (B). Presence of optimal distal blood flow after the balloon angioplasty. A short linear dissection image was present in the proximal part of the axillary artery without flow limitation (C).



**Figure 2.** The absence of the axillary blood flow has been detected after the recurrence of symptoms (A). After the balloon dilatation with 5.0 × 60 mm, 6.0 × 100 mm, and 6.0 × 17 mm self-expandable stents (Mustang 0.035" Balloon-Dilatation-Catheter-Boston Scientific) were implanted successfully (B). Optimal blood flow was provided after the implantation of stents (C).

outlet syndrome was also excluded. Thoracic outlet maneuvers were normal after the revascularization, and cervical spine x-ray did not show an anomalous cervical rib. Radiation-induced arteritis is considered the most probable etiology of peripheral arterial obstruction. Rhythm Holter did not reveal atrial fibrillation.

The patient was asymptomatic 6 months after the procedure, and the control Doppler examination revealed preserved blood flow in the right upper extremity arteries.

## DISCUSSION

The harmful effect of the radiation on the vascular system is thought to be related to intimal proliferation and fibrosis, luminal narrowing, obliteration of vasa vasorum, ischemic necrosis consisting of arterial changes due to radiotherapy.<sup>[5]</sup> These arterial changes predispose to mural thrombus formation and distal embolization.<sup>[2]</sup> These pathophysiologic mechanisms cause ischemia in the peripheral arteries such as subclavian or axillary arteries, which are exceedingly rare because of improvements to reduce the radiation dose.<sup>[1]</sup> The symptomatic disease usually occurs in the first 5 years after exposure to radiation, which is also present in our case.

Upper extremity arterial stenosis or occlusion may be caused by various etiologies such as atherosclerosis (most common), Takayasu arteritis, giant cell arteritis, thoracic outlet syndrome, etc. These possible etiologic reasons should be excluded before obtaining RIA diagnosis. Risk factors, symptoms, and other arterial lesions should be carefully investigated for atherosclerotic disease. Anamnesis, physical examination, and laboratory markers are essential to detect arterial vasculitis. Thoracic outlet syndrome should also be excluded with physical examination and chest X-ray.<sup>[6]</sup>

Treatment of this condition is not well-defined in the literature. Although there are few cases in the literature for use of the endovascular treatment for upper extremity ischemia associated with radiation, successfully managed cases treated by stenting without recurrence in the follow-up period were reported previously.<sup>[4]</sup> Surgical treatment for the RIA in the upper extremity is also not well-defined, and there are few cases in the literature with varying degrees of

success.<sup>[4]</sup> The need for extensive dissection and risk of infection in the previously irradiated regions are important issues while considering surgical revascularization.

RIA is an exceedingly infrequent condition and may present with upper extremity ischemia months or years after radiotherapy. Treatment of this condition is controversial despite the presence of surgical and endovascular options. In this case report, we presented a demonstrative example of percutaneously treated upper extremity ischemia due to RIA. Further data may provide a more extensive understanding of the management of this phenomenon.

\*Supplementary video files associated with this article can be found in the online version of the journal.

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**Keywords:** Radiation induced abnormalities; balloon angioplasty; peripheral arterial disease; young female arteritis

**Anahtar Kelimeler:** Radyasyona bağlı anormallikler; balon anjiyoplastisi; perifer arter hastalığı; genç kadın arteriti