RUPTURE OF COMMON FEMORAL ARTERY ANEURYSM WITH CONCOMITANT ILIAC ARTERY ANEURYSMS IN POST RADIOTHERAPY PATIENT – CASE REPORT

Bogomila Chesmedzhieva
UMHAT St.George, Plovdiv, Clinic of Vascular Surgery, Bulgaria, bogui_tch@yahoo.com,
Georgi Hristov
UMHAT St.George, Plovdiv, Clinic of Vascular Surgery,
MU Plovdiv, Department of Cardiovascular Surgery, Bulgaria, drgeorgihristov54@gmail.com
Anastas Cholakov
UMHAT St.George, Plovdiv, Clinic of Vascular Surgery, Bulgaria, anastascholakov@abv.bg
Stefan Stanev
UMHAT St.George, Plovdiv, Clinic of Vascular Surgery, Bulgaria, stanev.stefan.md@gmail.com
Desislava Kostova-Lefterova
Radiology Department, National Cardiology Hospital, Sofia, Bulgaria
Medical College, Medical University – Pleven, Pleven, Bulgaria
Radiology Department, University Hospital Aleksandrovska, Sofia, Bulgaria, dessi.zvkl@gmail.com

Abstract: Femoral and popliteal aneurysms can be limb threatening because of their potential for distal embolization, acute thrombosis and rarely rupture. Aneurysms of the common femoral artery are especially rare (up to 10 times more seldom than aortic aneurysms. As spontaneous rupture of infrainguinal aneurysm is very rare, there is also a risk of such rupture after radiation therapy.
Case report: Seventy-four-year-old female patient with history of pain and swelling of the right thigh and calf from 3 days. A hysterectomy due to cervical carcinoma with multiple chemo- and radiotherapy courses was performed 3 years prior. Two computed tomography angiographies (CTAs) were performed to monitor for metastases. No relapse of the oncological disease was found, but the CTAs revealed multiple aneurysms of the iliac arteries, and one of the right common femoral artery. Clinical status: painful swelling of the right thigh with pulsatile mass in the groin, subfascial oedema of the calf. Palpable pulses on the tibial arteries. Doppler ultrasonography – femoro-popliteal phlebothrombosis, aneurysmal dilatation of the common femoral artery. Computer tomography angiography – aneurysm of the right common iliac artery –34mm diameter; aneurysm of the left common iliac artery – 54mm diameter; aneurysm of the right common femoral artery – 108mm diameter with contrast extravasation and oedema of the surrounding tissues. Compression of the right femoral vein. Operative treatment: A median laparotomy was undertaken under general anaesthesia. Aorta was clamped 2 cm proximal of its bifurcation, inferior mesenteric artery was preserved. The proximal anastomosis of the aortobifemoral bypass was constructed over the aortic bifurcation with silver knitted Dacron prosthesis 18/9mm. Tunnelling of the branches was extremely difficult due to severe adhesions of the retroperitoneum. Operative access in the right inguinal area showed absence of arterial wall and capsule of false aneurysm. The ostial parts of superficial and deep femoral arteries were discovered in the cavity, approximately 10cm away from the most distal part of the external iliac artery. A neobifurcation was constructed and implanted to the right branch of the graft. In the left groin, a standard end-to-side anastomosis was constructed. The patient was discharged with therapy Edoxaban 30mg/daily and hypertension medications on the 15th postoperative day with primarily healing surgical wounds, actively mobilized with a bandage belt and elastocompression for the right leg. Bilateral foot pulses present.
Discussion: Radiation induced peripheral artery disease (RIPAD), after therapeutic irradiation of the abdomen, due to lymphoma, sarcoma or genitourinary malignancies has been reported by several studies. Clinical presentations of RIPAD in those cases vary from vase-renal hypertonia, chronic claudication to acute limb ischemia. Rupture of major vessel after irradiation is uncommon, but acute complication of radiotherapy. Common femoral artery is rarely affected by spontaneous rupture after irradiation, but it has been reported several times, mostly in conditions of slowly or non-healing wound, with death of haemorrhage as the most common outcome.
Conclusion: The presented clinical case demonstrates multiple vascular complications in irradiated patient, although we cannot fully associate those with the previous radiotherapy. Intraoperative challenges of tunnelling the right branch of the bypass were great, but the post-radiotherapy adhesions prevented asymptomatic rupture of the common femoral artery aneurysm.
Keywords: Radiation induced peripheral artery disease; Common femoral artery aneurysm; Rupture of peripheral aneurysm; Aortob`ifemoral bypass; Deep venous thrombosis

1. INTRODUCTION

Femoral and popliteal aneurysms can be limb threatening because of their potential for distal embolization, acute thrombosis and rarely rupture (Diwan et al, 2000). Aneurysms of the common femoral artery are especially rare (up to 10 times more seldom than aortic aneurysms (Savolainen et al, 2003). As spontaneous rupture of infrainguinal aneurysm is very rare, there is also a risk of such rupture after radiation therapy (Fajardo et al, 1975). Patients undergoing radiation therapy may develop various cardiovascular complications related to the radiation. This type of pathology is rarely recognized as radiation-induced cardiotoxic complications by clinicians, and there is no management algorithm for this type of patient. Ionizing radiation leads to the following radiation related complications: cardiovascular fibrosis of the entire cardiac system and significantly increases the risk of coronary disease, heart failure, right ventricular injury, cardiomyopathy, valvulopathy, arrhythmias, pericardial disease peripheral arterial disease, systemic hypertension, pulmonary hypertension and thromboembolic disease (Qianjun Pan et al., 2024; Nabiałek-Trojanowska et al., 2020; Zamorano et al. 2016; Mitchell et al. 2021). According to recent study, cases of patients with radiation induced rupture of femoral and popliteal aneurysms may be underreported due to the overall lack of published cases of peripheral vascular disease (Yang et al. 2021)

2. CASE REPORT

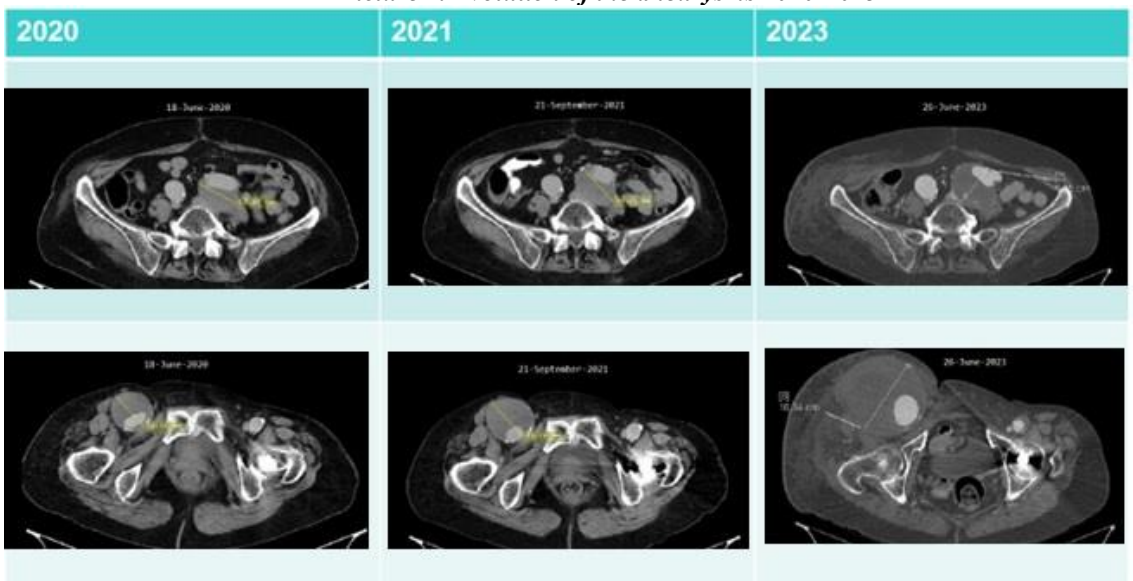
Seventy-four-year-old female patient with history of pain and swelling of the right thigh and calf from 3 days. A hysterectomy due to cervical carcinoma with multiple chemo- and radiotherapy courses was performed 3 years prior. There were two computed tomography angiographies (CTAs) performed to monitor for metastases. No relapse of the oncological disease was found, but the CTAs revealed multiple aneurysms of the iliac arteries, and one of the right common femoral artery (CFA) with no signs of rupture. Other concomitant diseases – arterial hypertension, diabetes and heavy smoking.

Clinical status: painful swelling of the right thigh with pulsatile mass in the groin, subfascial oedema of the calf. Palpable pulses on the tibial arteries. Blood pressure 180/100, Haemoglobin - 80.0 g/L, Haematocrit – 0.245 L/L, White blood cells - 12.01 10^9/l; Serum creatinine - 203.0 µmol/L; Serum urea - 15.6.

Doppler ultrasonography – femoro-popliteal deep venous thrombosis, aneurysmal dilatation of the common femoral artery – diameter 108mm with jet.

CTA – aneurysm of the right common iliac artery – 34mm diameter; aneurysm of the left common iliac artery – 54mm diameter; aneurysm of the right common femoral artery – 108mm diameter with contrast extravasation and oedema of the surrounding tissues. Compression of the right femoral vein.

Picture 1. Evolution of the aneurysms 2020-2023



Source: Preceding patient CTAs – due to carcinoma follow up (2020; 2021) and final CTA 2023

Picture 2. Reconstruction from the final CTA. Visualisation of the contrast jet from right femoral artery

Source: Preoperative CTA of the patient

Preoperative management included transfusion of 2 units RBC and 2 units of fresh frozen plasma, treatment of the arterial hypertension and preparation of the gastrointestinal tract.

Operative treatment

A median laparotomy was undertaken under general anaesthesia. Aorta was clamped 2 cm proximal of its bifurcation, inferior mesenteric artery was preserved. The proximal anastomosis of the aortobifemoral bypass was constructed over the aortic bifurcation with silver knitted Dacron prosthesis 18/9mm. Tunnelling of the branches was extremely difficult due to severe adhesions of the retroperitoneum.

Operative access in the right inguinal area showed absence of arterial wall and capsule of false aneurysm. The ostial parts of superficial and deep femoral arteries were discovered in the cavity, approximately 10cm away from the most distal part of the external iliac artery. A neobifurcation was constructed and implanted to the right branch of the graft. In the left groin, a standard end-to-side anastomosis was constructed.

Postoperatively 3 units of RBC and 3 units of fresh frozen plasma were transfused, prophylactic antibiotic therapy and anticoagulation with Enoxaparin - 12 000 IU/24 hours were initiated. Gastrointestinal transit was present at 12th hour.

The patient was discharged with therapy Edoxaban 30mg/daily and hypertension medications on the 15th postoperative day with primarily healing surgical wounds, actively mobilized with a bandage belt and elastocompression for the right leg. Bilateral foot pulses present.

Paraclinical parameters at discharge: HGB - 113.0 g/L; RBC - 3.92 10^12/l; HCT - 0.346 L/L; WBC - 9.23 10^9/l; CREA - 67.0 μmol/L; UREA - 7.1 mmol/L.

3. DISCUSSION

Multiple studies describe medial thinning and adventitial fibrosis of the major arteries, after radiotherapy (Virmani R et al, 1999; Stewart et al, 2006; Yang et al, 2021). High doses of ionizing radiation affect rapidly proliferating cells, such as cancerous, but also healthy cells – parenchymal, bone marrow and endothelial (Lee, 2012; Yang et al, 2021). The systematic review by Little at al. (2023), which covers 93 scientific publications on the availability of evidence to support a dose-related cause effect for ionizing radiation exposure, summarizes that the results support the occurrence of cardiovascular disease at high doses and to a lesser extent at low doses, with several examples of observed differences in the magnitude of risk between high-dose exposures for a short time or lower-dose exposures but over a prolonged period of time, where further studies are required. (Little et al.2023). Another narrative review by Manenti at al., (2024), reported the results of 27 articles showing a comprehensive evidence dataset on the relationship between radiation exposure and cardiovascular disease (Manenti et al. 2024). The authors observed positive correlation between ionizing radiation exposure and ischemic heart disease. Irradiation with ionizing radiation at dose rates in the range of those used in radiotherapy can lead to loss of vascular endothelial and parenchymal cells and cause micro- and macroangiopathy or monocyte cell killing in the arterial intima, radiation induced endothelial cell senescence and associated monocyte adhesion (Kim, 2014; Little et al, 2009; Lowe D & Raj K., 2014; Rombouts et al. 2014; Yentrapalli et al, 2013a; Yentrapalli et al, 2013b; Azimzadeh et al, 2015) The early radiation-induced cardiovascular effects, like vascular dysfunction, cardiac remodelling, and atherosclerosis seem to be caused by acute and chronic inflammatory changes (Manenti et al, 2024; Bhattacharya & Asaithamby, 2016) Such effect is well described in radiation-induced heart disease, but radiation-induced peripheral vascular disease is a growing problem (Zinzani et al, 1996). Dorrestejin et al. describe higher risk of ischemic stroke in younger age, after neck irradiation (Dorresteijn et al, 2002). Published data about radiation-induced peripheral artery disease (RIPAD) is limited. Radiation induced peripheral artery disease, after therapeutic irradiation of the abdomen, due to lymphoma, sarcoma or genitourinary malignancies has been reported by several studies. Clinical presentations of RIPAD in those cases vary from vaso-renal hypertonia, chronic claudication to acute limb ischemia (Milutinovic et al, 1990; Saka, 2003; Moutardier et al, 2002; Yang et al, 2021). Moutardier et al, 2002 reported severe iliac peripheral vascular disease in patients after cervical cancer radiotherapy treatment with preoperative external radiotherapy (40- 45Gy. vaginal brachytherapy excluded) presenting 1-47 years post irradiation period. Little at al., 2023, summarise all the available data, and their meta-analysis shows that patients who undergo high-dose procedures with the use of ionising radiation, such as radiotherapy, radionuclide treatment, fluoroscopically guided interventional procedures, or multiple high-dose diagnostic studies (CT or hybrid nuclear medicine examinations), may receive doses on the order of 0.1 Gy to the irradiated organs and tissues (Little at al, 2023). Little at al., 2023 calculated the lifetime risk to be 2.3-3.9 %. In case of patient treatment leading to absorbed heart dose in the order of 10-20 Gy the resulted lifetime risk of cardiovascular disease will exceeds 50% (Little at al, 2023). Such risks are justified and unavoidable consequence in the cases life-saving radiotherapy treatment. In general, the post-treatment benefits with improved cancer survival rate will exceed the risks of radiation-induced cardiovascular disease. Different authors recommend stenting instead of percutaneous balloon angioplasty alone as more effective treatment of RIPAD patients, particularly for iliofemoral disease after radiotherapy treatment, because of concurrent accelerated fibrosis and the associated elastic recoil (Saliou et al, 1997; Baerlocher et al, 2004; Yang et al, 2021).

Rupture of major vessel after irradiation is uncommon, but very dramatic acute complication of radiotherapy (Fajardo et al, 1975). This phenomenon is first reported by Cade et al. in 1940 (Cade, 1940). Several studies describe aorta, carotid and intracerebral arteries as most affected by this complication (Fajardo et al, 1975; McCready et al, 1983; Maruyama et al, 2000). Common femoral artery is rarely affected by spontaneous rupture after irradiation, but it has been reported several times, mostly in conditions of slowly or non-healing wound, with death of haemorrhage as most common outcome (Fajardo et al, 1975; Pararajasingam et al, 2002).

Liu et al, 2022, reported the long-term Cardiovascular-Specific Survival (CVSS) of 4 types of cancer, including cervix uteri and corpus uteri in their analysis (Liu et al, 2022). Their results showed that patients with cervix uteri and corpus uteri who underwent radiotherapy had significantly lower 40-year CVSS compared to patient without radiotherapy treatment (cervix uteri: 52.0% versus 80.6%, adjusted $P<0.001$; corpus uteri: 29.1% versus 38.1%, adjusted $P<0.001$). The authors also compare the relative risk of cardiovascular disease (CVD) deaths between patients with cervix uteri and corpus uteri and the general population. The risk of CVD death is higher for patients who underwent radiotherapy than among the general population.

4. CONCLUSION

The presented clinical case demonstrates multiple vascular complications in irradiated patient, although we cannot fully associate those with the previous radiotherapy. According to different authors, low dose rate exposures in the case of multifractionated radiotherapy treatment tend to be associated with higher cardiovascular heart disease risk

per unit dose. Intraoperative challenges of tunnelling the right branch of the bypass were significant, but the post-radiotherapy adhesions prevented asymptomatic rupture of the common femoral artery aneurysm. Implementation of strategies for the prevention of cardiovascular deaths in patients with cancer after radiotherapy is recommended.

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