Published in final edited form as:

Vasc Endovascular Surg. 2020 February ; 54(2): 172–174. doi:10.1177/1538574419887306.

A Hybrid Approach to Radiation-Induced Axillary Artery Hemorrhage

Elizabeth Hope Weissler, MD¹, Kevin W. Southerland, MD¹

¹Division of Vascular Surgery, Department of Surgery, Duke University Medical Center, Durham, NC, USA

Abstract

Axillary artery blowout is a rare life- and limb-threatening condition. The traditional surgical approach of ligation and extra-anatomic bypass is associated with a high morbidity and mortality. We present a case report of a 65-year-old male with axillary artery hemorrhage secondary to an irradiated squamous cell cancer. We propose a staged hybrid approach for the treatment of this unusual clinical entity consisting of emergent stent grafting followed by planned elective extra-anatomic bypass, debridement, and a course of specific antimicrobial therapy.

Keywords

hybrid intervention; upper extremity; hemorrhage; radiation damage; stent graft infection

Introduction

Axillary artery blowout is a rare life- and limb-threatening condition. It most commonly presents in patients with advanced breast or cutaneous malignancies who have a history of radiation therapy to the axillae. A traditional surgical approach of ligation and extra-anatomic bypass is associated with a high morbidity and mortality. We present a case report of a 65-year-old male with axillary artery hemorrhage secondary to an irradiated squamous cell cancer (SCC). We proposed a staged hybrid approach for the treatment of this unusual clinical entity. The patient consented to publication of this case.

Case Report

A 65-year-old male with a history of multiple cutaneous SCCs developed a 7-cm left axillary SCC. He underwent an axillary resection with positive margins and subsequently received adjuvant radiation therapy with 6000 cGy in 200 cGy fractions.

Two years following his initial presentation, he re-presented with a local recurrence of his axillary SCC along with pulmonary metastases. He was started on pembrolizumab, and he

Corresponding Author: Elizabeth Hope Weissler, Division of Vascular Surgery, Department of Surgery, Duke University Medical Center, 200 Morris Street, 7800-D, Durham, NC 27701, USA, hope.weissler@duke.edu.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

also received an additional dose of radiation to his left axilla (3000 cGy) for palliation. A month after completing his second-course of radiation, he reported some bleeding from his left chronic axillary wound (Figure 1) that resolved without intervention. Four months after his initial bleeding event, he presented to the emergency department with hemorrhage from his left axilla. On presentation, he was tachycardiac and anemic, with a hemoglobin of 7.2 mg/dL.

Direct pressure was applied to his left axilla and he was taken emergently to the operating room. In the operating room, the left radial artery was accessed with a micropuncture kit under ultrasound guidance. A 7F sheath was placed. A retrograde left arm arteriogram was obtained. There was no active extravasation on the arteriogram. However, given the massive hemorrhage from his axilla, an 8 mm × 100 mm Gore Viabahn Endoprosthesis was deployed in his left axillary artery. Completion arteriogram demonstrated excellent flow in the axillary artery. He was discharged on postoperative day 2 on dual-antiplatelet therapy.

A month later, the patient presented with purulent drainage from his left axillary wound and a white blood cell count of 16,400. Computed tomography scan showed air and fluid tracking along his left axillary artery stent into the pectoralis muscles (Figure 2). His blood cultures were positive for *Serratia marcescens* and he had septic emboli to his right index finger (Figure 3).

He was taken to the operating room for a left extra-anatomic carotid-brachial bypass with reversed saphenous vein and extirpation of his left axillary artery stent. Intraoperative cultures were positive for mixed gram-positive and gram-negative organisms, including *Serratia*. He subsequently required debridement of some devitalized tissue in his wound, followed by rotational chest flap coverage with plastic surgery. He was discharged home on a 6-week course of intravenous antibiotics. He has done well postoperatively, with no long-term evidence of infection.

Discussion

Radiation therapy is a mainstay for the treatment and palliation of a multitude of malignancies. Cutaneous manifestations, organ failure, and secondary malignancies are well-known sequelae of radiation therapy. Acute vascular catastrophes secondary to radiation have been sporadically reported in the literature. Two mechanisms are responsible for radiation-induced arterial rupture: (1) direct injury to the elastic layers of the arterial wall and (2) proximity to a colonized wound, which leads to arterial infection, aneurysmal degeneration, and rupture.¹

Management of spontaneous hemorrhage from an axillary artery rupture in a radiated field is a challenging dilemma. Surgical management of this injury would require a supraclavicular approach for proximal control. Surgical control of hemorrhage is a difficult task in this setting, given the hostile operative field secondary to fibrosis from radiation. An endovascular strategy is an alternative to the traditional surgical approach.

Placement of a covered stent graft is an expeditious strategy to achieve both hemorrhage control and limb preservation with minimal morbidity. However, there are several limitations

to this method. First, prosthetic material is placed in a contaminated environment. Second, both infected and necrotic tissue are not debrided. Finally, infected tissue is not obtained for microbiologic culture data. Despite these disadvantages, endovascular management is emerging as suitable alternative for mycotic aortic aneurysms because of the significant decrease in morbidity and mortality.²⁻⁴ However, it remains to be seen whether this evidence can be safely applied to patients with radiation-induced arterial perforation.

The literature regarding radiation-induced great vessel hemorrhage is quite limited. Cenizo et al reported a small case series with 2 patients with innominate artery pseudoaneurysms secondary to radiation. Both patients were treated through a retrograde carotid approach and a self-expanding covered stent. Exclusion of the pseudoaneurysm was successful in both cases. However, one of the patients re-presented with an infected stent and died of sepsis despite being on antibiotics.⁵ Ewings et al reported a case of a subclavian artery blowout following neck and chest radiation for Hodgkins lymphoma. The patient was initially treated with coil embolization. In the immediate postoperative period, the patient re-bled and was treated with a covered stent. Several months later, the patient presented again with hemorrhage and was managed with an additional stent graft.¹ These case reports highlight the fact that endovascular approaches to radiation-induced arterial perforation are excellent at halting life-threatening hemorrhage in a timely fashion; however, an endovascular strategy has limited durability due to the high risk of recurrent infection in the setting of chronic wounds and ongoing malignancy.

Radiation-induced arterial perforation is a rare problem and consensus guidelines will likely never exist. Therefore, the optimal management for this problem needs to be determined on a case-by-case basis. We recommend that strong consideration be given to a staged hybrid repair, which consists of emergent stent grafting followed by a planned elective extra-anatomic bypass with debridement of infected and necrotic tissues. A staged hybrid repair combines the perioperative morbidity and mortality benefits of an endovascular repair with the durability of open surgical repair. A critical component of the hybrid approach is the extirpation of the infected artery and soft tissue, as this significantly reduces the probability of recurrent infections and provides microbiologic data to guide antimicrobial therapy.

Conclusion

Radiation-induced axillary artery hemorrhage is a life- and limb-threatening clinical dilemma. Open surgical repair in this setting is associated with high morbidity and mortality. Endovascular stent grafting prevents exsanguination, but its durability is limited by recurrent infection and sepsis. We recommend a staged hybrid approach consisting of emergent stent grafting, suppressive antibiotics followed by elective extra-anatomic bypass, debridement, and a course of specific antimicrobial therapy.

Acknowledgments

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

1. Ewings EL, Wittgen CM, Paletta CE. Prolonged success with a covered endovascular stent after emergent use in radiation-induced subclavian artery blowout: a case report. *Vasc Endovascular Surg*. 2008;42(2):187–191. [PubMed: 18421037]
2. Luo CM, Chan CY, Chen YS, Wang SS, Chi NH, Wu IH. Long-term outcome of endovascular treatment for mycotic aortic aneurysm. *Eur J Vasc Endovasc Surg*. 2017;54(4):464–471. [PubMed: 28826996]
3. Luo Y, Zhu J, Dai X, et al. Endovascular treatment of primary mycotic aortic aneurysms: a 7-year single-center experience. *J Int Med Res*. 2018;46(9):3903–3909. [PubMed: 29962258]
4. Di X, Liu C, Zeng R, Ni L. Endovascular aortic repair is a viable strategy for treatment of primary infected abdominal aortic aneurysm. *Ann Vasc Surg*. Epub ahead of print 22 February 2019. doi:10.1016/j.avsg.2018.12.080.
5. Cenizo NM, Gonzalez-Fajardo JA, Ibanez MA, et al. Endovascular management of radiotherapy-induced injury to brachiocephalic artery using covered stents. *Ann Vasc Surg*. 2014;28(3):741. e15–18.

Figure 1.
Left axillary wound during initial admission for hemorrhage.

Figure 2.
Computed tomography scan showing air around stent graft at the time of presentation with leukocytosis.

Figure 3.
Septic embolus to the right index finger.