



Hybrid Treatment of Complex Para-anastomotic Aortic Arch Pseudoaneurysm

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Abstract

Keywords

- ▶ arch aneurysm
- ▶ arch pseudoaneurysm
- ▶ reverse femoroaxillary bypass

The development of pseudoaneurysms increases with time since the original operation, with incidence 0.2 to 25%. The axillofemoral bypass is employed to treat selective aortoiliac obstructions. Rarely, it is used in reverse form and always for treatment of occlusive arterial disease. We report a para-anastomotic aortic arch pseudoaneurysm and add to the literature a successful hybrid treatment, with bilateral femoroaxillary bypasses, thromboexclusion of all supra-aortic trunks, and aortic arch covering with an endograft.

The risk of development of anastomotic pseudoaneurysms increases with time since the original operation. The incidence varies broadly, ranging from 0.2 to 25%. This condition is believed to be underdiagnosed.¹ In 1963, Blaisdell and Hall performed the first axillofemoral bypass.² This procedure is indicated in selective aortoiliac occlusive disease and as an alternative in order to bypass contaminated thoracic or abdominal aortic grafts, prior to their removal. The main indications are hostile abdomen, multiple previous procedure, in high-risk and seriously compromised patients. Rarely, this approach has been used in a reverse form, with flow inverted from the femoral arteries to the supra-aortic trunks, and when employed with this objective, always for the treatment of occlusive arterial disease.³ We could find no reports of this therapeutic option for the treatment of para-anastomotic thoracic aortic pseudoaneurysms.

We report a para-anastomotic aortic arch pseudoaneurysm (PAAAP), adding to the literature an unusual hybrid treatment, with bilateral femoroaxillary bypasses, followed by thromboexclusion of all supra-aortic trunks and aortic arch.

Clinical Presentations

A 79-year-old man, was admitted in Copa D'Or Hospital, in Rio de Janeiro, Brazil, reporting two episodes of right cervicobrachialgia and syncope, in 1 week. Both events occurred after rising from a chair, with anterior flexion of the neck, and were followed by falling back in the seat. Five years previously, he had undergone uneventful aortic valve and ascending aorta replacement, extending up to the brachiocephalic trunk (BCT).

On physical exam, he was hemodynamically stable, eupneic, and normotensive, with a regular pulse. A pulsatile mass was palpable behind the manubrium. Duplex scan of the cervical arteries disclosed damped common carotid and subclavian peak systolic velocities and flow reversal in left common carotid artery (LCCA). Both carotid bulbs were aneurysmatic (diameters: right 19 and left 12 mm). Trans-thoracic echocardiogram showed a voluminous pulsating hematoma, grafts, suggesting a pseudoaneurysm. Computerized angiotomography (ATC) of the thorax and neck confirmed PAAAP, originating from the distal anastomosis

received
April 25, 2023
accepted after revision
July 16, 2024

DOI <https://doi.org/10.1055/s-0044-1791241>.
ISSN 2325-4637.

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of the Dacron tube, with 120 × 70 mm, compressing the supra-aortic branches. The adjacent thrombus was in close contact with the posterior sternum and the manubrium (→Fig. 1A–C). Angiography of the coronaries was normal. Angiography of the supra-aortic trunks confirmed ATC findings, evidencing retrograde flow in the LCCA, through a widely open circle of Willis.

Median sternotomy was not an option. We conceived a hybrid procedure, providing flow to the supra-aortic vessels through bilateral femoroaxillary bypasses, implant of the left common carotid into the ipsilateral subclavian artery (with LCCA ligature), and thromboexclusion of both the BCT and proximal left subclavian artery (LSA). To complete the process, a thoracic endograft was implanted into the aortic arch, from the ascending to the descending aorta, with exclusion of the PAAAP.

The procedure was performed in a hybrid room, under general anesthesia, with hemodynamic, transesophageal echocardiographic, and neurologic monitoring. Cerebral Oximetry, 8-Channel EEG, and somatosensory and motor evoked potentials, were utilized. The common femoral, proximal axillary, LCCA, and left midsubclavian arteries were surgically exposed. Tunnels connecting the groin and upper chest incisions were created. Under full heparinization, two ringed 8-mm Gore Propaten PTFE (WL Gore, Flagstaff, AZ) grafts were anastomosed to the common femoral arteries and transferred through the tunnels and anastomosed to the axillary arteries. With retrograde flow restored on both sides, an 18-mm Amplatzer Plug (Abbott, Plymouth, MN) was implanted into the proximal BCT, under radiographic guidance. The proximal LCCA was ligated as deep as possible in the upper mediastinum and transferred to the midsubclavian artery. The LCCA was thickened and friable, so this anastomosis was less than ideal. Through a distal common femoral access, a long 8F sheath was inserted in the proximal LSA—during this maneuver a dissection of the large proximal left vertebral occurred—with near-occlusion of the flow. The vertebral dissection was immediately treated by implantation of a 6 × 40 mm Zilver (Cook,

Bloomington, IN) stent. Occlusion of the LSA followed, via implantation of a 12-mm Amplatzer Plug. An ultra-stiff guidewire was negotiated through the prosthetic valve into the left ventricle. After rapid-pacing at 180 bpm for 40 seconds, a 40 × 200 mm Gore C-TAG endograft was precisely implanted, from just above the coronary ostia, to the proximal descending aorta. After expansion with Gore Tri-Lobe balloon, control angiography showed complete exclusion of the PAAAP and adequate supra-aortic irrigation. The surgical procedure lasted 9 hours. A drawing of the procedure is shown in →Fig. 2.

The intraoperative course was complicated by need for massive transfusion. The patient was extubated on the first operative day. His course was complicated by pneumonia and left flank cellulitis. He was discharged from the intensive care unit on the 10th operative day and went home on the 25th operative day, on antibiotics. He developed pseudo-membranous enterocolitis on the 35th operative day, being readmitted for 2 days before final discharge. A pre-discharge computerized tomography angiography (CTA) showed a well-positioned aortic arch endograft, widely patent femoroaxillary grafts and total exclusion of the proximal arch vessels. The proximal LCCA was occluded, but flow to the carotid bulb in retrograde fashion was evident.

During follow-up, the original symptoms disappeared totally, with slow but positive return to normal activities. Control CTA during the second postoperative month showed results similar to the previous study (→Fig. 3). The main complaint of the patient was that his treating physicians disallowed his prior prolonged sauna sessions, with finishing cold shower. The patient is doing well, to date.

Discussion

Pseudoaneurysms usually develop due to progressive leaking of pulsatile arterial blood from a damaged artery. They have been related to several pathogenic conditions, like traumatic arterial lesions, local and systemic infection, inflammatory reactions, and commonly to anastomotic line

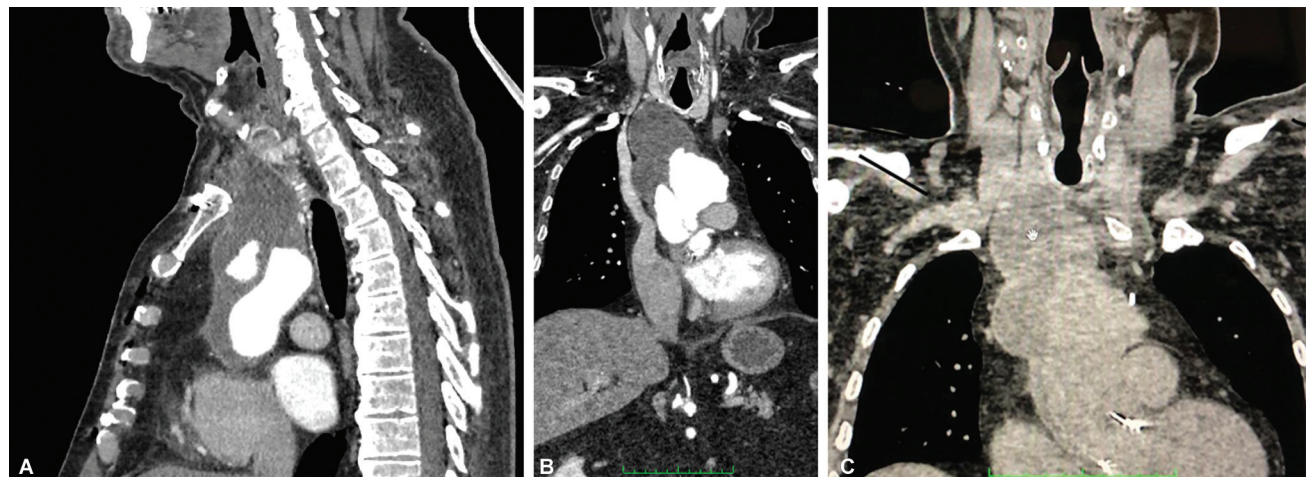


Fig. 1 Preoperative chest and neck computerized angiography (ATC). (A) Axial study—PAAAP. (B) Coronal slice—PAAAP reaching the neck. (C) Sagittal view—PAAAP abutting the manubrium. PAAAP, para-anastomotic aortic arch pseudoaneurysm.

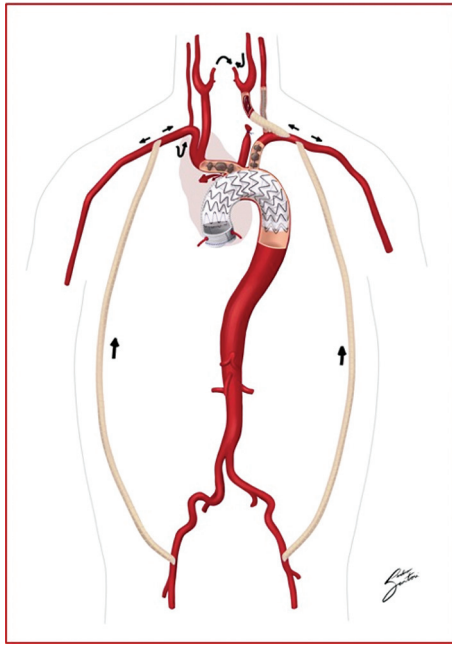


Fig. 2 Artistic rendering of the complete procedure. Arrows indicate the direction of blood flow.



Fig. 3 Postoperative computerized tomography angiography of the complete procedure.

rupture. The leak is progressive and tends to grow quickly, leading to hemorrhage into body cavities or, as mostly feared, to the exterior.

Most cases occur in elderly individuals with several comorbidities. High mortality rates have been reported for open surgical treatment of PAAAP: emergency surgery yields a morbidity of 70 to 83% and a mortality ranging from 7 to

70%.¹ The need for prolonged clamp times, extracorporeal circulation, and deep hypothermia makes these surgeries challenging. Currently, endovascular repair has become the preferred approach to treat descending thoracic aneurysms (thoracic endovascular aortic repair [TEVAR]) and pseudoaneurysms.

Unfavorable anatomy has been the main contraindication to TEVAR: inadequate proximal and distal sealing and anchoring zones, extreme tortuosity, large aortic diameters, branches arising from the sac, and lack of adequate access vessels are the most prevalent specific impediments. In this case, an exclusively TEVAR procedure was impossible due to the involvement and compression and kinking of all supra-aortic trunks. Our original intention was to treat this PAAAP with a branched aortic endograft, but the anatomy was inappropriate even with the use of a custom made device. An alternative approach had to be considered. Our option was a hybrid treatment, associating two femoroaxillary bypasses to a TEVAR.

Axillofemoral and axilobifemoral bypasses are routine techniques to revascularize the lower limbs.² The use of femoral inflow to revascularize the brain has been applied previously, usually unilaterally.^{3,4} To our knowledge, this approach to treat arch aneurysms in the face of contraindication to median sternotomy has not been reported. This approach is particularly attractive to treat challenging cases in which a standard sternotomy is both dangerous and impossible.

Conclusion

Close follow-up is recommended in all prosthetic reconstructions of the aorta, especially to detect pseudoaneurysmal anastomotic degeneration. A hybrid approach, with femoroaxillary bypasses and endovascular treatment of an aortic arch aneurysm, can be offered as an effective alternative to high-risk direct approach, specifically in case of unfavorable involvement of the supra-aortic trunks.

Conflict of Interest

None declared.

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