Archivos Peruanos de Cardiología y Cirugía Cardiovascular

Arch Peru Cardiol Cir Cardiovasc. 2021;2(3):211-215.

Case report

Acute Stanford type A aortic dissection associated with aortic coarctation repaired by Tirone E. David & debranching techniques with combined axillar and femoral perfusion: a case report

Francisco Guerrero[1], Karla Bautista[1], Giuseppe Salas[1], Edmy Callalli[1], Josías C. Ríos[2]

Received: September 6, 2021.
Accepted: September 30, 2021.

Filiation
[1] Cardiothoracic Surgery Department. Hospital Nacional Hipólito Unanue. MINSA. Lima, Perú.
[2] Cardiovascular Surgery Department. Instituto Nacional Cardiovascular INCOR. EsSalud. Lima, Perú.

***Correspondence**
Francisco Guerrero
Miguel G. Seminario 190. San Isidro. Lima, Perú.
(+51) 939561859

Email
francscg@outlook.com

Conflict of interest
None.

Funding
Self-financed.

How to cite:
Guerrero F, Bautista K, Salas G, Callalli E, Ríos JC. Acute Stanford type A aortic dissection associated with aortic coarctation repaired by Tirone E. David & debranching techniques with combined axillar and femoral perfusion: a case report. Arch Peru Cardiol Cir Cardiovasc. 2021;2(3):211-215. doi: 10.47487/apcyccv.v2i3.154.

ABSTRACT

We present the case of a 38-year-old male with a diagnosis of Stanford A aortic dissection and associated coarctation of the thoracic aorta. Acute dissection associated with coarctation of the aorta is a rare problem and difficult to manage surgically. Establishing a cardiopulmonary bypass (CPB) with adequate flows is the main objective of the procedure; optimal cannulation ensures the protection of cerebral and visceral organs. We successfully performed aortic valve re-implantation surgery (T. David Surgery), replacement of the ascending aorta and aortic arch, as well as debranching of the supra-aortic trunks. The cannulation technique was axillary and femoral to guarantee flows through the coarctation area.

Keywords: Aneurysm, dissecting; Aortic coarctation; Aortic valve insufficiency; Aortic valve prolapse (source: MeSH NLM).

RESUMEN

Disección aórtica aguda Stanford A asociada a coartación de aorta reparada por técnica de Tirone E. David y debranching con perfusión combinada axilar y femoral: reporte de un caso

Presentamos el caso de un varón de 38 años con diagnóstico de disección de aorta Stanford A y coartación de aorta torácica asociada. La disección aguda asociada a la coartación de la aorta es un problema raro y difícil de manejar quirúrgicamente. Establecer un bypass cardiopulmonar con flujos adecuados es el principal objetivo del procedimiento; una canulación óptima asegura la protección de órganos cerebrales y viscerales. Realizamos con éxito una cirugía de reimplante de válvula aórtica (cirugía de T. David), reemplazo de la aorta ascendente y del arco aórtico, además de debranching de los troncos supraaórticos. La técnica de canulación fue axilar y femoral para garantizar flujos a través de la zona de coartación.

Palabras clave: Aneurisma Disecante; Coartación Aórtica; Insuficiencia de la Válvula Aórtica; Prolapso de la Válvula Aórtica (fuente: DeCS BIREME).

Introduction

Acute aortic dissection is a rare and fatal disorder, due to the separation of the layers of the aortic wall. A tear in the intimal layer produces a retrograde or proximal blood flow between intima and media, which causes the formation of a false lumen within the middle tunic. Statistics show that 60% of patients die within 30 days if they do not undergo surgery [1]. The Stanford A dissection causing a rupture on the aortic root, ascending aorta, aortic arch, supra-aortic trunks, and descending aorta is associated with very high mortality. When aortic coarctation is also found, maintaining good cerebral and systemic perfusion during surgery is a great challenge [2]. This type of dissection should be repaired immediately with lifesaving emergency surgery. Therefore, an adequate cannulation and temperature control strategy must be planned to guarantee adequate cerebral perfusion during the time of circulatory arrest and also guarantee a good systemic perfusion during surgery [1,3].

Our surgical team used both femoral and axillary cannulation strategies as a solution to perfusion problems due to coarctation of the aorta. We performed replacement of the aortic root, aortic arch and supra-aortic trunks with valve preservation and coronary reimplantation.

Case report

A 38-year-old man, without cardiovascular risk factors, and no history of Marfan syndrome, was admitted to the emergency unit after an episode of chest and lumbar pain. On physical examination, we found blood pressure 150/66 mmHg (right arm), 144/53 (left arm), and 125/45 in lower limbs; a heart rate of 72 beats per minute, and a grade III systo-diastolic murmur in the right parasternal focus. Transthoracic echocardiography revealed an aneurism of the ascending aorta and arch (diameter of 8 cm), with aortic root and arch dissection (Stanford A / De Bakey II). The flap prolapsed into the left ventricle in the cardiac diastole. Severe aortic regurgitation (type IA) and bicuspid aortic valve were observed. The left ventricular ejection fraction (LVEF) was 55%, the right ventricle systolic function was preserved, and no motility disorders were found. Computed tomography angiogram showed a Stanford Type A aortic dissection (with supra-aortic trunks dissection extended to descending aorta) and coarctation of the thoracic aorta **(Figure 1).**

The cardiac team decided emergency surgical treatment. A median sternotomy was performed, cannulation strategies for cardiopulmonary bypass included arterial cannulation both in the right axillary (8 mm prosthesis as an interposed graft) and in the right femoral arteries, venous cannulation was performed in the right atrium directly **(Figure 2).** Surgical findings showed a severely dilated ascending aorta (approximately 80 mm) with dissection signs. After aortic clamping, we used HTK Custodiol® for cardiac protection directly in both coronary arteries. The sectioned and excised aorta showed a dissection flap extending to the three supra-aortic trunks and into the coronary sinuses near the border of both coronary arteries. Bicuspid aortic valve (three sinuses, right-left fusion, symmetric type) was observed.

We decided to repair the root using the re-implantation technique (David´s original procedure) and replace the aortic arch and the ascending aorta with a Dacron prosthesis. We used a 28 mm prosthesis for the aortic root replacement. After re-implantation of the aortic valve, we repaired both aortic leaflets (repair of the prolapse and suture of the raphe of the fused leaflet), and then coronary arteries were re-implanted. With the patient in deep hypothermia (24 °C) prepared for circulatory arrest, we clamped the brachiocephalic trunk, so that total anterograde cerebral perfusion was obtained with bilateral carotid artery perfusion assured. We used a 28 mm prosthesis for ascending aorta and arch replacement. The anastomosis between the thoracic aorta and the graft was performed under circulatory arrest. The next step was the anastomosis of supra-aortic vessels (brachiocephalic and left carotid arteries), performed by debranching technique with an adapted bifurcated prosthesis (20 x 10 mm). The proximal prothesis-to-prothesis anastomosis was then performed.

After systemic rewarming, the aorta clamp was removed, and the myocardium was re-perfused again. Cardiopulmonary bypass was easily turned off with low doses of inotropic support. Total cardiopulmonary bypass (CPB) time was 3 hours 39 minutes, aorta cross-clamp 3 hours 6 minutes, and cardiac arrest 26 minutes. In the critical care unit, the patient´s evolution was satisfactory with no neurological disorders. After a six-month follow-up, the patient was in functional class I, with normal left ventricular function and a mild aortic valve insufficiency with adequate gradients (medium: 8 mmHg).

Discussion

Acute Stanford A aortic dissection is a complex life-threatening disease, associated with high morbidity and mortality and is even more challenging when is combined with coarctation of the aorta [3]. The characteristics of the blood flow in the ascending aorta make this region the most frequently affected [4,5]. Stanford A dissection

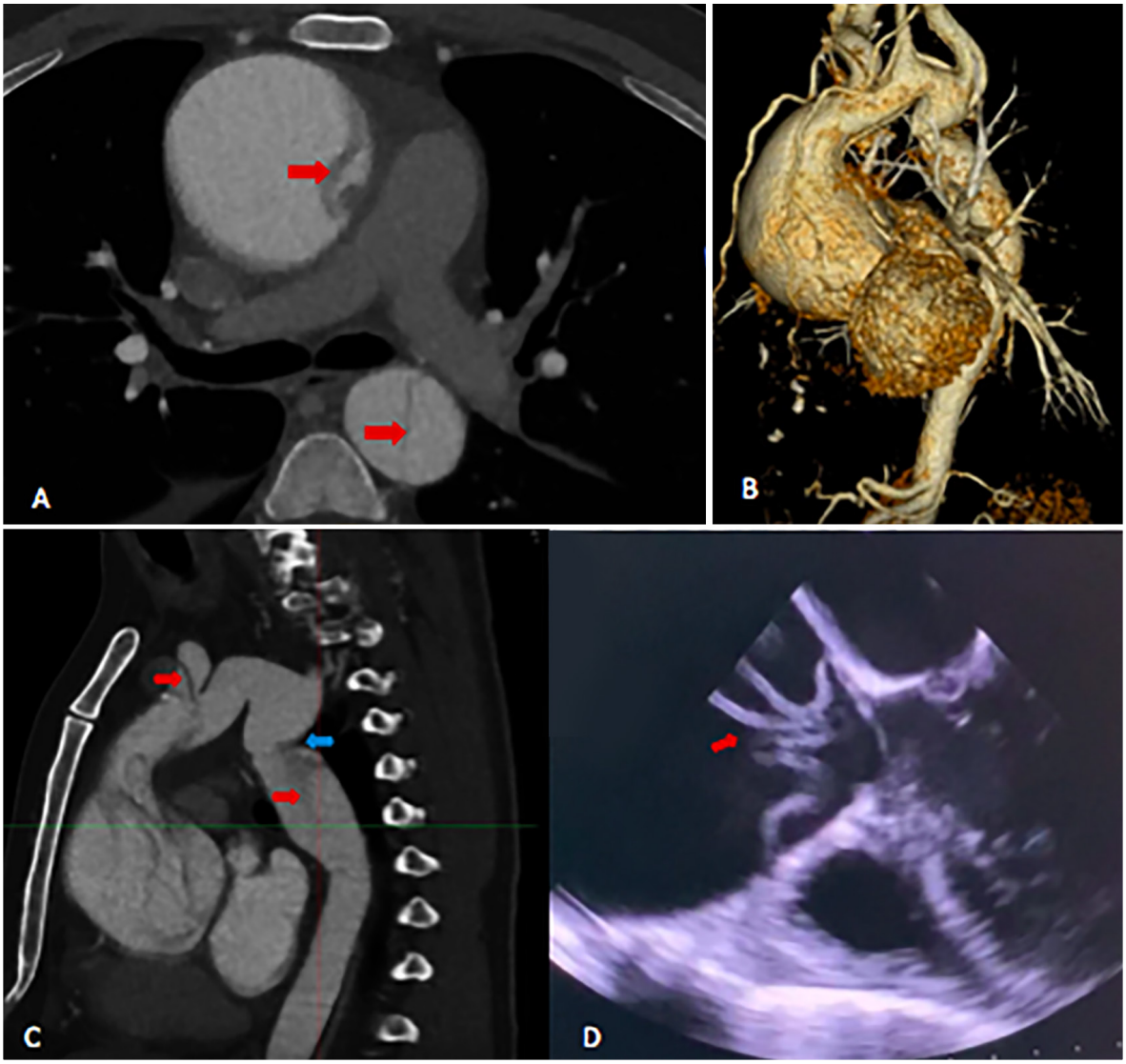

Figure 1. A). Contrast-enhanced computed tomography, axial section of the upper thorax showing signs of dissection of the ascending and descending aorta (red arrow). **B).** 3D reconstruction showing the aneurysm of the ascending aorta involving the root **C).** Sagittal section of the thorax, it is observed that the dissection flap extends to the supra-aortic trunks and the descending aorta, in addition the coarctation of the thoracic aorta is observed (arrow blue). **D).** Transesophageal echocardiography, showing an aortic root dissection flap.

is always a surgical challenge due to the involvement of the aortic root (in some cases the coronary arteries), the ascending aorta, and the supra-aortic trunks, which puts cerebral circulation at risk. If we consider the existence of coarctation of the thoracic aorta, the difficulty in maintaining adequate cerebral and systemic perfusion during surgery increases. In fact, the clue and the key to good results start with a good perfusion strategy, to preserve cerebral and systemic blood flow during surgery and thus avoid cerebral, renal and splanchnic ischemia [6].

There are many reports about cannulation techniques in these patients, we decided to solve the problem by placing a "Y" connection in the arterial line and performed double peripheral cannulation. We used axillary cannulation to reduce complications in the nervous central system performing anterograde perfusion including the pre aortic coarctation zone [7]. There are no doubts about the advantage of this type of cannulation, but to protect the perfusion of the organs beyond coarctation, we performed femoral cannulation (the site of choice for many years in some centers), this is a safe but non-physiological perfusion, and it is not recommended only when the dissection extends to the iliac or femoral arteries and when the thoracoabdominal aorta has severe atherosclerosis [1-3,8].

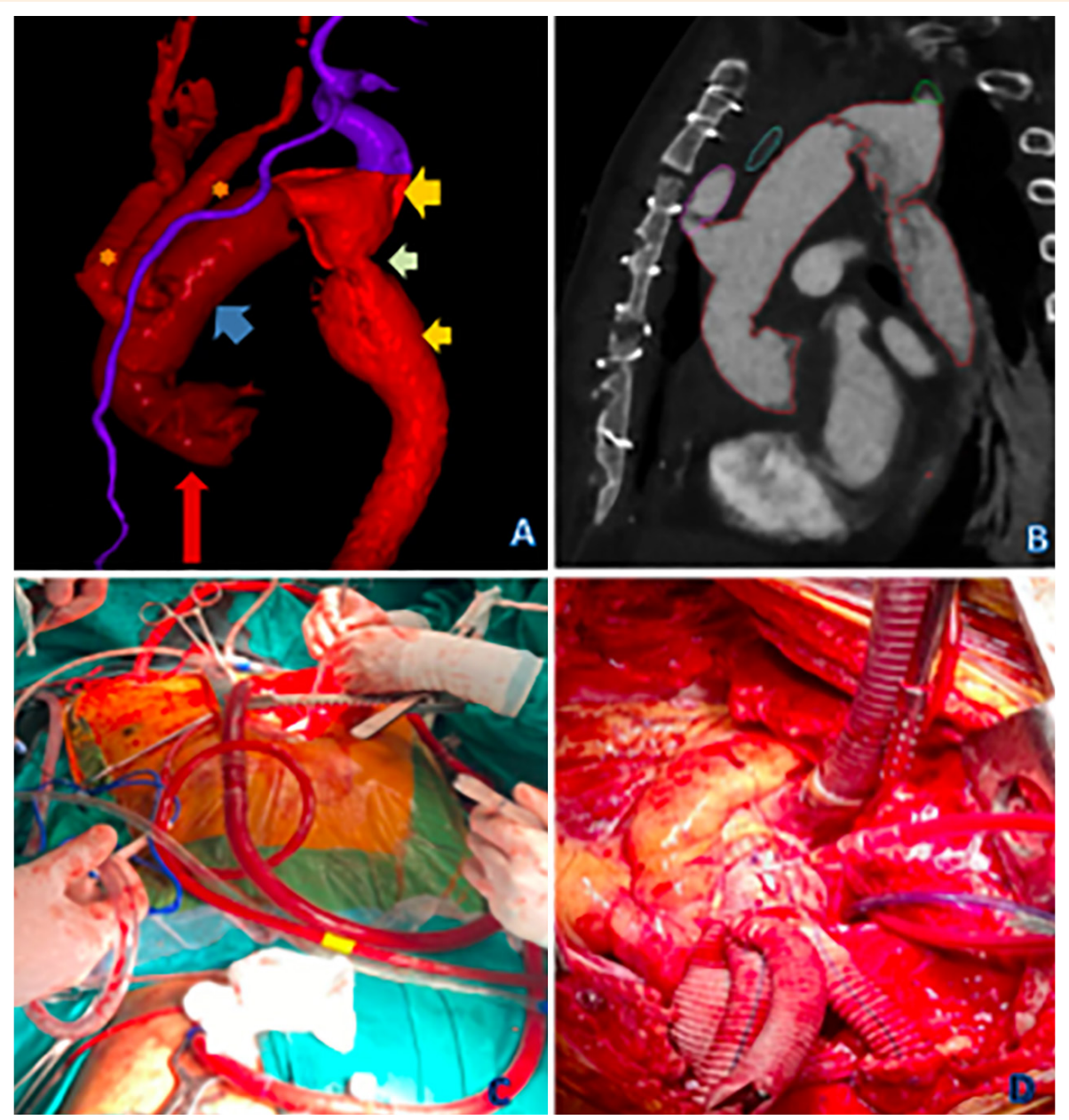

Figure 2. Postoperative images **(A, B):** 3D volumetric reconstruction **A)** shows the aortic root graft (red arrow) and the ascending aortic graft (blue arrow). Debranching to the brachiocephalic and left carotid trunk (asterisks) is also observed. The yellow and gray arrow indicates the aortic coarctation. **C)** Axillary and femoral cannulation for CPB. **D)** Dacron graft implanted in the ascending aorta and supra-aortic trunks.

Lin-Chen *et al*., in a two-year prospective study, showed better results (fewer neurological symptoms, renal and hepatic insufficiency, limb ischemia, and paraplegia) using axillary and femoral cannulation, their complication rates did not exceed 2.36% [7].

The American Association of Thoracic Surgery Consensus Guidelines for Bicuspid Aortic Valve-Related Aortopathy states that patients with a bicuspid aortic valve with symmetric leaflets are candidates for valve-sparing surgery. In the case of valve leaflet prolapse, this can be corrected with the plication of the free edge. Long-term survival and reoperation-free survival results are greater than 80% at 10 years in large series [9-11].

The key point of this case report is the incidental finding of coarctation of the aorta in acute type A aortic dissection, which in addition to being a rare combination, increased the difficulty in achieving adequate perfusion during surgery.

Arch Peru Cardiol Cir Cardiovasc. 2021;2(3):211-215. doi: 10.47487/apcyccv.v2i3.154.

Thus, this combined approach: axillary to the pre-coarctation and femoral cannulation to the above coarctation zone could be considered a useful and safe alternative in patients who present this disease.

References

1. Abe T, Usui A. The cannulation strategy in surgery for acute type A dissection. Gen Thorac Cardiovasc Surg. 2017;65(1):1-9.
2. Horai T, Shimokawa T, Takeuchi S, Okita Y, Takanashi S. Single-Stage Surgical Repair of Type II Acute Aortic Dissection Associated With Coarctation of the Aorta. Ann Thorac Surg. 2007;83(3):1174-5.
3. Svensson LG. Management of acute aortic dissection associated with coarctation by a single operation. Ann Thorac Surg. 1994; 58(1):241-3.
4. Elsayed RS, Cohen RG, Fleischman F, Bowdish ME. Acute Type A Aortic Dissection. Cardiol Clin. 2017;35(3):331-45.
5. Merkle J, Sabashnikov A, Liebig L, Weber C, Eghbalzadeh K, Liakopoulos O, et al. Factors predictive for early and late mortality after surgical repair for Stanford A acute aortic dissection. Perfusion. 2019;34(5):375-83.
6. Jormalainen M, Raivio P, Mustonen C, Honkanen H-P, Vento A, Biancari F, et al. Direct Aortic Versus Peripheral Arterial Cannulation in Surgery for Type A Aortic Dissection. Ann Thorac Surg. 2020; 110(4): 1251-8.
7. Huang L, Xu Q, Chen D, Dai X, Chen L. Combined femoral and axillary perfusion strategy for Stanford type a aortic dissection repair. J Cardiothorac Surg. 2020; 15(1): 326.
8. Fusco DS, Shaw RK, Tranquilli M, Kopf GS, Elefteriades JA. Femoral Cannulation is Safe for Type A Dissection Repair. Ann Thorac Surg. 2004;78(4):1285-9.
9. Borger MA, Fedak PWM, Stephens EH, Gleason TG, Girdauskas E, Ikonomidis JS, et al. The American Association for Thoracic Surgery consensus guidelines on bicuspid aortic valve–related aortopathy: Full online-only version. J Thorac Cardiovasc Surg. 2018;156(2):e41-74.
10. David TE. Aortic Valve Sparing in Different Aortic Valve and Aortic Root Conditions. J Am Coll Cardiol. 2016;68(6):654-64.
11. Bavaria JE, Desai N, Szeto WY, Komlo C, Rhode T, Wallen T, Vallabhajosyula P. Valve-sparing root reimplantation and leaflet repair in a bicuspid aortic valve: comparison with the 3-cusp David procedure. J Thorac Cardiovasc Surg. 2015 Feb;149(2 Suppl):S22-8.