

# Extraanatomic Correction for the Long-Interrupted Segment of the Isthmic Aorta in Adult Patients

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## ERİŞKİN HASTALARDA AORTANIN UZUN KESİNTİLİ SEGMENTİNİN EKSTRAANATOMİK DÜZELTİLMESİ

### ÖZET

Çocukken düzeltici operasyon gerekeceği için, erişkinlerde kesintili aort kavsi nâdir görülen bir konjenital anomali-dir. Kliniğimizde uzun kesintili aorta kavsi olan 3 erişkin hasta opere edildi. Tüm hastalarda, istmik aortanın kesilmiş segment bölümünde tüp grafo interpozisyonu yapıldı. Düzeltilen segmentlerde rezidü basınç farkı kalmadı. Bypass graftı erişkin hastalarda kesintili aort kavsinin tedavisi için emin ve kolay bir metottur.

**Anahtar kelimeler:** Ekstra-anatomik bypass, kesintili aort kavsi

Interruption of aorta in adult patients is a rare vascular anomaly, because it has >90% mortality rate in the first year of life if it is not corrected (1). Particularly, the complex forms of coarctation or interruption of isthmic aorta, which interrupt the blood flow between ascending and descending aorta completely, but have not hindered the normal development of the lower body-part, are very uncommon. Because of the extremely poor natural history of this condition, operation is usually required early in infancy. We reported three adult cases with this anomaly.

### Case-1

19-year old male patient with headache, nose bleeding, dyspnea after physical exercise was referred to our clinic for operation of an interrupted segment of the aorta. On physical examination we found that the lower extremities' pulses were nonpalpable. We heard a diastolic murmur on the left border of the sternum. The blood pressure was 180/120 mmHg in both arms and 100/50 mmHg in both legs. The growth of his lower-body part was normal and he had no physical anomaly. Chest x-ray showed evidence

of cardiomegaly and definite notching of the ribs. Echocardiography revealed an interrupted segment of the isthmic aorta after left subclavian artery, left ventricular hypertrophy (interventricular septum was 1.6 cm, posterior wall was 1.2 cm) and minimal aortic insufficiency. At the catheterization a long interrupted segment was seen between left subclavian artery and distal descending aorta. The large collaterals filled the descending aorta. A left posterolateral thoracotomy through 4th intercostal space was performed. When the descending aorta was explored a long and thin fibrous tissue (8 cm) without any lumen was observed between the left subclavian artery and the descending aorta. The collateral circulation was well developed. Bypass was performed with a 14-mm tubular Gore-tex graft between the left subclavian artery and the distal part of the descending aorta under partial cross clamping. We used nitroprusside during operation and early postoperative period to control hypertensive attacks. He was discharged from the hospital without any complication. He did not use any antihypertensive agent since surgery and his blood pressure was 120/80 mmHg. On control echocardiography and angiography in the third year after the operation we observed that the left ventricular hypertrophy had regressed (interventricular septum was 1.1 cm, posterior wall was 1 cm).

### Case-2

Fourteen old female patient with headache, palpitation and weakness was sent to our clinic for the operation of an interrupted segment of the aorta. On physical examination we found that the lower extremities' pulses were nonpalpable. The blood pressure was 190/90 mmHg in both arms and 80/50 mmHg in both legs. The growth of her lower-body part was normal and she had not any physically anomaly. Chest x-ray showed evidence of cardiomegaly and definite notching of the ribs. Echocardiography revealed an interrupted segment of the isthmic aorta after left subclavian artery and left ventricular hypertrophy (interventricular septum was 1.2 cm, posterior wall was 1.1 cm). Aortic angiography revealed a long interrupted segment between the proximal and distal parts of the descending aorta that was filled by the large collaterals. A left posterolateral thoracotomy through 4th intercostal space was performed. When the descending aorta was explored it was observed a long and thin fibrous tissue (7 cm) without any lumen between the proximal and distal parts of the descending aorta. The collateral circulation had been well developed. A 14-mm tubular Gore-Tex graft was anastomosed between the proximal and distal parts of the de-

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scending aorta. She was discharged from the hospital without any complication. She did not use any antihypertensive agent and her blood pressure was 115/70 mmHg. We performed a control echocardiography and angiography in the first year after the operation (Fig.-1). The left ventricular hypertrophy has regressed and the bypass graft works very well.

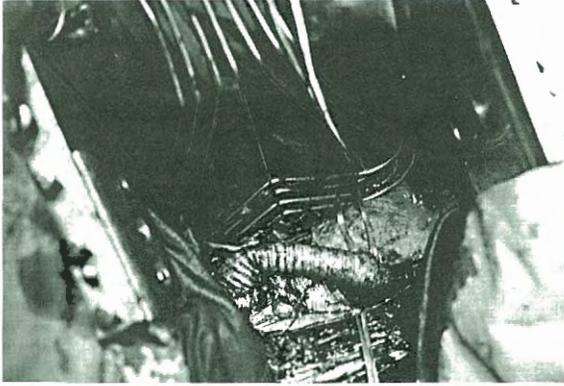


Figure 1. The angiographic view of the tubular graft between the proximal and distal parts of the descending aorta.

### Case 3

Thirty-one old male patient with headache, nose bleeding, dyspnea after physical exercise was sent to our clinic for the operation of a interrupted segment of the aorta. On physical examination we found that the lower extremities' pulses were nonpalpable. The blood pressure was 170/110 mmHg in both arms and 100/50 mmHg in both legs. The growth of his lower-body part was normal and he had no physical anomaly. Chest x-ray showed evidence of cardiomegaly and definite notching of the ribs. Echocardiography revealed an interrupted segment of the isthmic aorta after left subclavian artery, left ventricular hypertrophy (interventricular septum was 1.6 cm, posterior wall was 1.3 cm) and minimal aortic insufficiency. At the catheterization it was seen a long interrupted segment between left subclavian artery and distal descending aorta. A left posterolateral thoracotomy through 4<sup>th</sup> intercostal space was performed. When the descending aorta was explored it was observed a long and thin fibrous tissue (4 cm) without any lumen between the left subclavian artery and the descending aorta. Bypass was performed with a 12-mm tubular Hemoguard graft between the left subclavian artery and the distal part of the descending aorta under the partial cross-clamping (Fig.2). We used nitroprussid during the operation and early postoperative period to control hypertensive attacks. He was discharged from the hospital without any complication. His blood pressure was 110/70 mmHg. Postoperative echocardiography showed that there was no residual gradient.

### DISCUSSION

Aortic interruption in adults usually presents with upper-body hypertension typically in the second or third decade of life. Although these patients com-

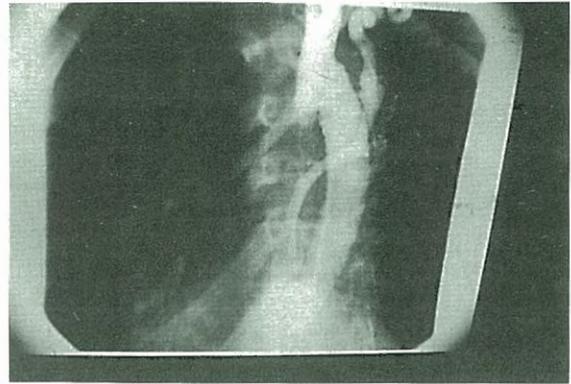


Figure 2. The intraoperative view of the latero-isthmic bypass graft between the left subclavian artery and the descending aorta.

prise a selected group that have survival, free of complications beyond childhood. In adults with interruption of the aorta there is usually an extensive collateral circulation. Surgical repair is indicated when the gradient across the lesion is greater than or equal to 30 mmHg at rest. At the aortic catheterization we measured the systolic gradients between 55 and 110 mmHg. Since the first successful repair of aortic coarctation, surgical repair of complex forms of coarctation (long coarctation, aortic wall calcification, extensive or minimal collateral circulation, multiple previous operations) in older patients (> 14 years) has been always the important problem (2,3). When anastomotic repair is used, the increased mortality is related to intraoperative hemorrhage and the other complications such as paraplegia, recurrent laryngeal nerve damage, phrenic nerve paralysis, chylothorax and intrathoracic sepsis are more frequent (3). Paraplegia remains the most feared complication of operation for aortic coarctation or interruption (4).

Age at the repair of interruption is the most significant risk factor for premature death after operation. Preexisting cardiac and vascular damage from years of exposure to elevated blood pressure related to the interruption play a major role in this problem. Surgical repair of interruption in adults is an effective, low-risk procedure, which results in a significant improvement in systolic and diastolic hypertension and a decreased requirement of antihypertensive medications. The preferred method for simple coarctation is resection with end-to-end anastomosis; tube-graft interposition is rarely used (5). Adult patients (> 13 years) with complex forms of aortic coarctation or interruption of the aorta remain a technical challenge

and represent a high-risk group for postoperative mortality and morbidity (6). It has been reported that a bypass graft procedure is the only treatment way for these patients (7-9). In these patients, end-to-end anastomosis or patch graft aortoplasty cannot be successful as a prohibitive risk of intraoperative, postoperative and long-term complications because of the often extremely friable tissue and the length of the interruption. If the interrupted part of the isthmic aorta is long enough not to allow performing end-to-end anastomosis or patch repair as was in our cases tube-graft interposition is the only method to correct the complex forms of coarctation. When interruption does not extend to the origin of the left subclavian artery, we choose a left subclavian artery-descending aorta bypass graft to provide the continuity of the aorta. The interrupted aorta of adult patients is relatively immobile and there are frequently large collaterals immediately adjacent to the interrupted segment. These make bypass grafting from the left subclavian artery to the descending aorta an attractive option (5). In the second patient we found that the blind proximal part of the descending aorta was almost intact to perform the anastomosis.

There are few reports concerning the long-term outcome of bypass grafting for complex forms of coarctation (3,10). Potential drawbacks of the use of prosthetic material are thrombosis, infection, and false or true aneurysm formation. We have not seen any complication of these surgical repair techniques. Bypass grafting should be the procedure of choice in adult patients with interrupted aorta or complex form aortic coarctation.

## KAYNAKLAR

1. **Monro JL, Bunton RW, Sutherland GR, Keeton BR:** Correction of interrupted aortic arch. *J Thorac Cardiovasc Surg* 1989; 98: 421-7
2. **Crafoord C, Nylín G:** Congenital coarctation of the aorta and its surgical treatment. *J Thorac Cardiovasc Surg* 1945; 14: 347-53
3. **Grinda JM, Mace L, Dervanian P, Folliquet TA, Nevenx JY:** Bypass graft for complex forms of isthmic aortic coarctation in adults. *Ann Thorac Surg* 1995; 60: 1299-302
4. **Leberg DB, Hardesty RL, Siewers RD, Zuberbühler JR, Bahnson HT:** Coarctation of the aorta in infants and children: 25 years of experience. *Ann Thorac Surg* 1982; 33: 159-70
5. **Lacks H, Marelli D, Drinkwater DCJr:** Surgery for adults with congenital heart disease. In Edmunds LH (ed): *Cardiac Surgery in the Adult*. New York: McGraw Hill Company; 1997:1368-70
6. **Liberthson RR, Pennington DG, Jacobs ML, Daggett WM:** Coarctation of the aorta: review of 234 patients and classification of management problems. *Am J Cardiol* 1979; 43: 835-40
7. **Wells WJ, Prendergast TW, Berdjis F, et al:** Repair of coarctation of the aorta in adults: The fate of systolic hypertension. *Ann Thorac Surg* 1996; 61: 1168-71
8. **Ralph-Edwards AC, Williams WG, Coles JC, Rebeika IM, Trusler Ga, and Freedom RM:** Reoperation for recurrent aortic coarctation. *Ann Thorac Surg* 1995; 60: 1303-7
9. **Jacob T, Çobanoğlu A, Starr A:** Late results of ascending aorta-descending aorta bypass grafts for recurrent coarctation of aorta. *J Thorac Cardiovasc Surg* 1988; 95: 782-7
10. **Palatianos GM, Karsev GA, Thurer RJ, Garcia O:** Changing trends in the surgical treatment of coarctation of the aorta. *Ann Thorac Surg* 1988; 40: 41-5