# Endovascular repair of an abdominal aortic aneurysm associated with crossed fused renal ectopia

Elda Chiara Colacchio, MD,[a] Marc Coggia, MD,[b] Matteo Salcuni, MD,[c] Donato Giorgio, MD,[d] Gianni De Robertis, MD,[d] *and* Giovanni Colacchio, MD,[d] *Padua, Crotone, and Acquaviva delle Fonti, Italy; and Paris, France*

## ABSTRACT

Chimney/snorkel endovascular aneurysm repair (Ch-EVAR) enables the minimally invasive treatment of abdominal aortic aneurysm in anatomically challenging and high-risk surgical cases. Here, we present the case of a 77-year-old man with an abdominal aortic aneurysm associated with crossed fused renal ectopia and an ectopic renal artery arising directly from the aneurysm sac. After successful implementation of Ch-EVAR, computed tomography angiography at 18 months revealed no endoleaks, patency of the parallel graft, and normal renal vascularization and function. This report underscores the feasibility of Ch-EVAR in a case with high anatomic complexity. (J Vasc Surg Cases and Innovative Techniques 2020;6:140-2.)

**Keywords:** Abdominal aortic aneurysm; Chimney endovascular aneurysm repair; Crossed fused renal ectopia

Chimney/snorkel endovascular aneurysm repair (Ch-EVAR) is an increasingly used minimally invasive technique that demonstrates promising midterm results for the treatment of complex abdominal aneurysms.[1] In this report, we present the case of a patient with an abdominal aortic aneurysm (AAA) associated with crossed fused renal ectopia, a rare congenital kidney abnormality in which the kidneys are fused and located on the same side of the body.[2] Implementation of Ch-EVAR allowed the preservation of ectopic renal artery patency in a patient with high cardiovascular and respiratory risk. The patient has agreed to the publication of images and details related to his case.

## CASE REPORT

A 77-year-old man with a history of hypertension, hypercholesterolemia, severe chronic obstructive pulmonary disease, and coronary artery disease presented with a 60-mm, asymptomatic AAA and associated crossed fused renal ectopia. The right kidney was located underneath and fused to the left kidney. The right ectopic renal artery had a diameter of 4.5 mm and arose directly from the aneurysm sac (Fig 1).

The aneurysm was treated by a parallel graft technique. Stent graft sizing was performed using the Lachat formula.[3] The diameters of the aortic landing zone and the parallel graft were 25.5 mm and 5 mm, respectively. Therefore, we chose a 28-mm stent graft (ETBF 28-13-145 Endurant; Medtronic, Minneapolis, Minn).

**Fig 1.** Multiplanar reconstruction image of the abdominal aortic aneurysm (AAA) with the ectopic renal artery arising from the aneurysm sac (*arrow*).

A percutaneous, ultrasound-guided, left brachial access allowed us to catheterize the ectopic kidney artery with a Rosen guidewire (Cook Medical, Limerick, Ireland). A 6F Flexor sheath (Cook Medical) was then inserted in the ostium of the artery.

From the Department of Cardiac, Thoracic, and Vascular Sciences, Vascular and Endovascular Surgery Section, University of Padua, Padua[a]; the Department of Vascular Surgery, Ambroise Paré University Hospital, Boulogne-Billancourt, and Faculty of Health Sciences Simone Veil, Versailles Saint-Quentin-en-Yvelines University, Paris-Saclay University, Paris[b]; the Department of Radiology and Interventional Radiology, Marrelli Hospital, Crotone[c]; and the Department of Vascular and Endovascular Surgery, General Regional Hospital Ente Ecclesiastico "F.Miulli," Acquaviva delle Fonti.[d]

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Correspondence: Giovanni Colacchio, MD, Department of Vascular and Endovascular Surgery, General Regional Hospital Ente Ecclesiastico "F.Miulli", Strada Provinciale 127 Acquaviva-Santeramo, km 4.100, 70021 Acquaviva delle Fonti, Bari, Italy (e-mail: gm.colacchio@gmail.com).

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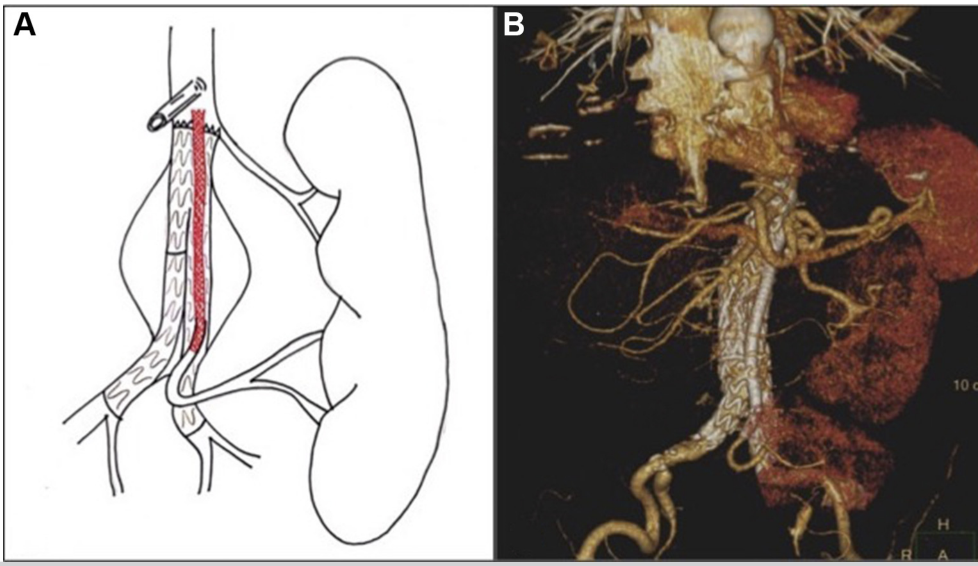


**Fig 2.** Drawing of the adopted chimney technique **(A)** and its three-dimensional reconstruction **(B).**

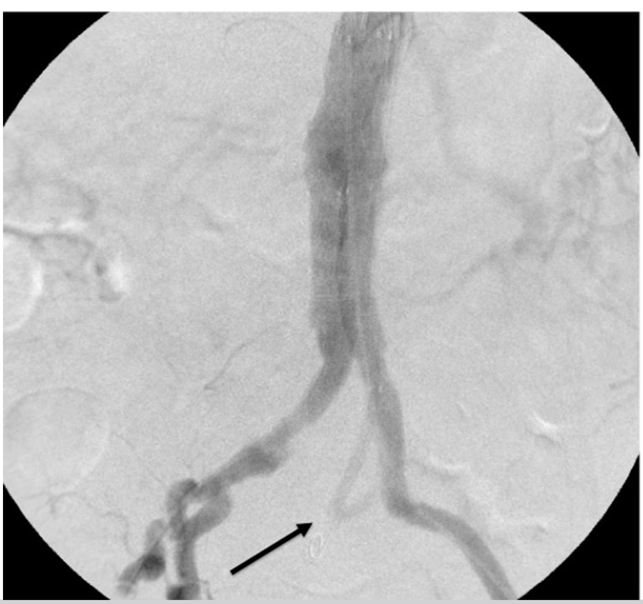

**Fig 3.** Intraoperative angiography showing patency of the ectopic renal artery after completion of the procedure (*arrow*).

The main body of the endoprosthesis (Endurant) was introduced through a left femoral access and then positioned undeployed in the abdominal aorta below the left renal artery. A Viabahn stent graft (5 × 150 mm; Gore Medical, Flagstaff, Ariz) was released in the ectopic right renal artery, and a balloon (5 × 150 mm; Pacific [Medtronic]) was positioned inside the stent graft.

The main body endograft was opened. We then performed a kissing balloon technique with the first balloon positioned inside of the Viabahn stent graft and a second balloon (Reliant AB46 [Medtronic]) positioned in the proximal end of the main body. The procedure was completed with deployment of the remainder of the aorto bi-iliac endograft. We reinforced the Viabahn stent graft with an E-Luminexx stent (6 × 120 mm; BD Interventional, Tempe, Ariz) to avoid kinking of the parallel graft. The stent was eventually shaped with an identically sized balloon (6 × 120 mm; Pacific; Fig 2).

Final angiography revealed patency of the Viabahn stent graft inside the ectopic renal artery (Fig 3) with normal vascularization of the renal parenchyma. No endoleaks were detected. Renal function testing revealed no changes in serum creatinine concentration on days 1 and 3. Accordingly, the patient was discharged on day 3. Follow-up imaging at 3, 6, 12, and 18 months after the procedure confirmed patency of the stent grafts with normal renal vascularization. No endoleaks were detected, and progressive shrinkage of the aneurysm sac (60 mm before the procedure vs 50 mm 18 months after the procedure) was observed.

## DISCUSSION

Initially introduced as a bailout technique,[4] Ch-EVAR has become a valid alternative to fenestrated EVAR for the treatment of juxtarenal and pararenal aortic aneurysms. In this case of AAA, our goal was to preserve patency of the ectopic renal artery as this artery was responsible for vascularization of the right ectopic kidney. We considered several options in light of the patient's cardiovascular, pulmonary, and metabolic risk factors. An open surgical technique would have involved laparotomy, aortic cross-clamping below the left renal artery, and right renal ischemia of at least 30 minutes before connection to the surgical graft. We rejected that option because aortic surgery and renal reimplantation are associated with substantial rates of complications.[5] The second option was a hybrid treatment including direct surgical reimplantation of the ectopic renal artery or a prosthetic bypass from the left external iliac artery to the ectopic renal artery, both with an extra-anatomic approach, followed by EVAR as an immediate or delayed treatment. However, we believe that the passage of the endoprosthesis shaft into a shaggy iliac axis may have led to left renal embolism. A "reverse" parallel duct, such as a right iliac "periscope" technique, had a morphologic bias as the three-dimensional representation showed a significant angle of the parallel graft in the aneurysm sac. The last option was to use a fenestrated or branched stent graft. This solution was rejected, considering the manufacturing time of the stent graft in a patient with a large AAA. Finally, we elected to use a parallel snorkel technique to permit correct vascularization of the ectopic kidney artery while maintaining a linear morphology and parallelism of the main graft to the chimney graft. Although the coverage of polar renal arteries is reported in the literature with no significant changes in renal function,[6] the Society for Vascular Surgery recommends the preservation of renal arteries with a diameter superior to 3 to 4 mm.[7]

Our particular case raises two important issues. First, our case addresses the patency of a chimney graft of 15 cm in length. A successful result in this case considered alongside positive midterm follow-up reports of Ch-EVAR in various studies suggests that this technique yields excellent patency.[1] The second issue relates to the difficulty of maintaining parallelism and the position of a long chimney graft during the procedure. Use of a balloon-expandable stent graft can facilitate parallelism and positioning, but at the time of our case, available balloon-expandable stent grafts did not exceed 6 cm in length. Instead, our stent graft was positioned with the protection of a long sheath and subsequently released and maintained in the correct position with a balloon while the aortic endograft was deployed. Computed tomography angiography and follow-up of the patient at 18 months revealed no endoleaks, patency of the parallel graft, and preservation of renal function.

## CONCLUSIONS

The Ch-EVAR technique can be used to preserve the patency of visceral arteries arising from the aneurysm sac and permit EVAR in high-risk cases. Our case demonstrates the feasibility and utility of Ch-EVAR in a patient with a particularly challenging anatomy. We need larger series and long-term follow-up to draw firm conclusions on the durability of this technique.

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