

# Hybrid repair of aortic aneurysm in a patient with a congenital pelvic kidney

Halli Krzyzaniak, MD, BSc,<sup>a,b</sup> Naomi Wedel, MD, BSc,<sup>a,b</sup> Ali Fatehi Hassanabad, MD, PhD,<sup>a,c</sup> Richard Cormack, MD, FRCPC,<sup>d</sup> and Kenton Rommens, MD, FRCSC,<sup>a,b,e</sup> *Calgary, Alberta, Canada*

## ABSTRACT

We describe a patient with an asymptomatic infrarenal abdominal aortic aneurysm. Treatment decisions were complicated by the presence of a left congenital pelvic kidney supplied by two renal arteries originating from the proximal common iliac arteries bilaterally and respiratory status that was prohibitive to open repair. A hybrid surgical repair was performed with a bifurcated aortic endograft and parallel grafting to revascularize the pelvic renal arteries. This procedure was combined with a right common iliac endovascular occlusion and femoral-femoral bypass. This case adds to the limited reports of endovascular management of patients with concomitant aneurysmal disease and ectopic kidneys. (*J Vasc Surg Cases Innov Tech* 2025;11:101708.)

**Keywords:** Aortic aneurysm; Pelvic kidney; Endovascular repair; Ectopic kidney

Congenital pelvic kidneys (CPK) are the rarest type of renal ectopia, estimated to occur in 1 in 2000 to 3000 births.<sup>1</sup> The incidence of concurrent CPK and abdominal aortic aneurysms (AAAs) is not well-known, with one study reporting an incidence of 0.18% and another review reporting <50 cases.<sup>2,3</sup> The anomalous renal vasculature associated with CPK complicates endovascular repair of concurrent AAA. This case report describes a hybrid repair with a parallel grafting technique (PGT) in a patient with CPK and infrarenal AAA. The patient consented to the publication of their case and images.

## CASE REPORT

An 80-year-old man with a history of atrial fibrillation on rivaroxaban, hypertension, dyslipidemia, prior smoking, chronic obstructive pulmonary disease, chronic kidney disease (CKD), and coronary artery disease was found incidentally to have a 6.9-cm fusiform infrarenal AAA. His right kidney was in normal anatomical position and his left kidney was malrotated in his pelvis. The left CPK was supplied by two arteries (4 mm each) originating from the proximal common iliac arteries (CIAs) bilaterally (Fig 1). Owing to his severe chronic obstructive pulmonary disease (forced expiratory volume in 1 second of 0.63 L), he was considered risk prohibitive for open repair.<sup>4</sup> A nuclear medicine scan demonstrated that the CPK contributed 30% of

renal function. Given his preexisting CKD (baseline estimated glomerular filtration rate of 30-40), endovascular exclusion of the CPK would significantly worsen his renal function. Therefore, a hybrid repair strategy with PGT was planned.

Bilateral femoral cutdowns were performed. The main body of the GORE Excluder (W. L. Gore & Associates, Flagstaff, AZ) endoprosthesis was introduced on the left side and deployed until the contralateral gate was exposed. The left axillary artery was exposed and antegrade access was achieved through the main body of the endoprosthesis and out the contralateral gate. The pelvic renal arteries were cannulated and sequential Viabahn self-expanding stent grafts (W. L. Gore & Associates) were used to build backwards starting with 5 mm × 5 cm, then 7 mm × 5 cm and ending with 10 mm × 5 cm in the contralateral gate to achieve endoseal (contralateral gate measured 13 mm). The renal stents were ballooned to profile in a kissing fashion within the contralateral gate. Oversized Viabahn self-expanding stents were used over balloon-expandable stents to maximize the elliptical configuration within the cylindrical contralateral limb and reduce potential gutter leak. The remainder of the ipsilateral limb was deployed. An Amplatzer plug (Abbott Cardiovascular, Minneapolis, MN) was deployed in the right CIA to occlude retrograde flow into the aneurysm sac. Completion angiogram demonstrated patency of the repair with a slow gutter leak from the contralateral gate and a type II endoleak. A left-to-right femoral-femoral bypass using 8 mm Propaten PTFE graft (W. L. Gore & Associates) was completed to maintain flow to the right lower extremity.

A contrast-enhanced ultrasound examination on postoperative day (POD) 1 demonstrated an early type III endoleak, although the study was of low quality. A CTA on POD 3 showed patent grafts and branch reconstructions with contrast surrounding the right contralateral limb, related to a gutter leak or a type III from the renal stent graft overlap. Given this finding, his rivaroxaban was held with a plan to follow his endoleak as an outpatient. He was discharged on POD 8 with renal function better than his baseline.

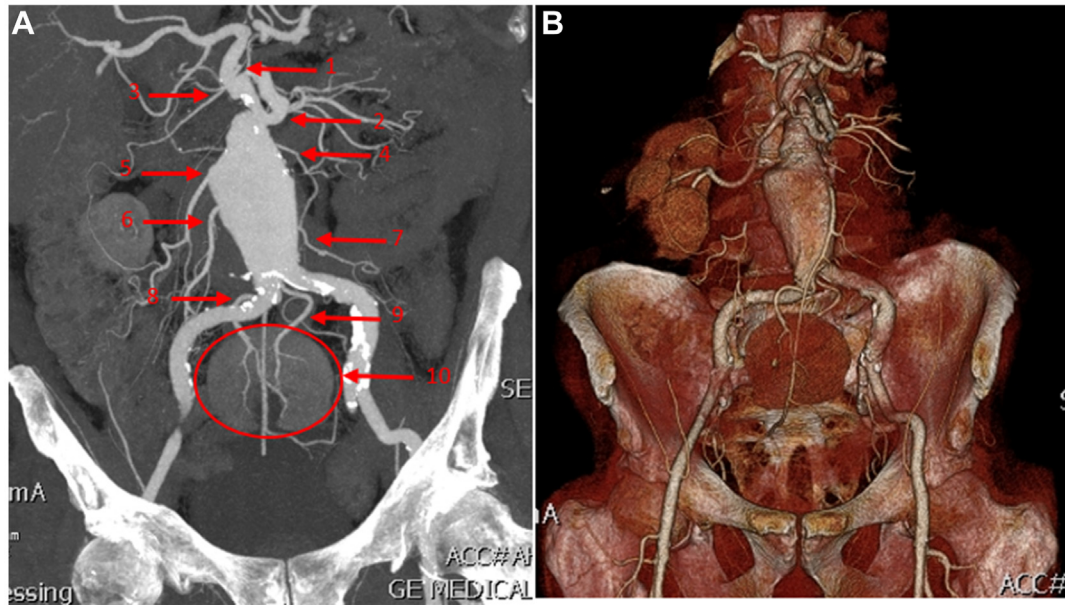
From the Libin Cardiovascular Institute,<sup>a</sup> Division of Vascular Surgery,<sup>b</sup> Section of Cardiac Surgery,<sup>c</sup> and Division of Interventional Radiology,<sup>d</sup> University of Calgary; and the Calgary Aortic Program, Libin Cardiovascular Institute.<sup>e</sup>  
Correspondence: Naomi Wedel, MD, BSc, Division of Vascular Surgery, 3500 26 Ave NE, Calgary, Alberta T1Y 6J4, Canada (e-mail: [naomi.wedel@albertahealthservices.ca](mailto:naomi.wedel@albertahealthservices.ca)).

The editors and reviewers of this article have no relevant financial relationships to disclose per the Journal policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2468-4287

© 2024 The Authors. Published by Elsevier Inc. on behalf of Society for Vascular Surgery. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

<https://doi.org/10.1016/j.jvscit.2024.101708>



**Fig 1.** Computed tomography angiogram (A) and Terarecon three-dimensional reconstruction (B). Preoperative imaging of infrarenal abdominal aortic aneurysm (AAA) with left pelvic kidney (10) and pelvic renal arteries (8 and 9) arising from bilateral proximal common iliac arteries (CIAs). Important arterial branches are also labelled: celiac (1), superior mesenteric (2), right renal (3), inferior mesenteric (6), and lumbar (4, 5, and 7).

At the 1-month postoperative visit, repeat contrast-enhanced ultrasound did not find any evidence of a type III endoleak. He did have a type II endoleak at the posterior aspect of his aortic bifurcation. This finding was confirmed on CTA 1 week later and was associated with aneurysm sac expansion to 7 cm (increased from 6.9 cm) (Fig 2). He was awaiting embolization of this type II endoleak with 10-mm sac expansion. On POD 87, he suffered a ground-level fall at home and while being transported by medical services went into cardiac arrest and was unable to be resuscitated. A bedside ultrasound examination performed during the code did not demonstrate any free fluid in the abdomen suspicious for aortic rupture after EVAR. The presumed cause of death is an acute coronary syndrome given his cardiac history rather than secondary to a rupture from the type II endoleak given his presentation (no abdominal or back pain, no decrease in hemoglobin or hematocrit).

## DISCUSSION

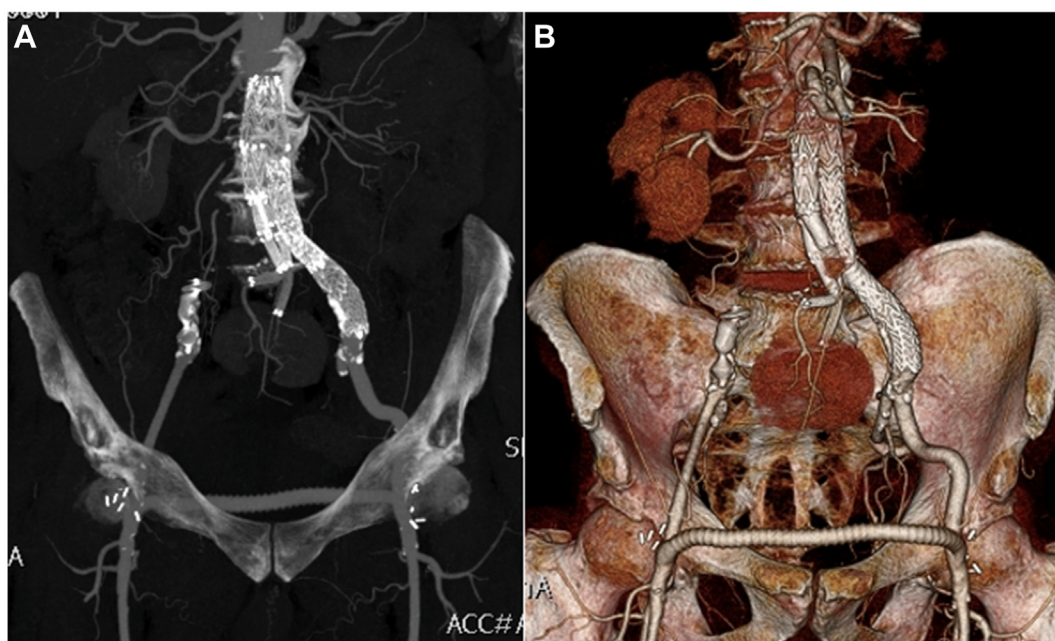
This case outlines a hybrid approach to treating infrarenal AAA with associated CPK using infrarenal EVAR with PGT of the pelvic renal arteries and a femoral-femoral bypass. The challenges for this case included patient comorbidities that made open repair risk prohibitive and preexisting renal dysfunction that made preservation of his CPK a priority.

The treatment of concurrent CPK and AAA was complicated by an anomalous renal vasculature; most cases reported in literature are treated with open surgery.<sup>3,5</sup> For patients unfit for open repair, endovascular approaches have been described. A standard endovascular technique may require sacrifice of one or more

ectopic renal arteries.<sup>3,6-8</sup> The European Society for Vascular Surgery recommends preserving renal arteries >4 mm or those that supply more than one-third of the kidney.<sup>9</sup> Complex endovascular techniques include fenestrated and branched endografts, but these specialized grafts may not be available owing to time pressure or system barriers.<sup>10,11</sup> Another complex endovascular approach is PGT, which includes sandwich, periscope, snorkel, or chimney techniques.<sup>12,13</sup>

A few case reports have described using PGT for the management of AAA and associated CPK renal vasculature.<sup>14-18</sup> Three case reports describe a chimney technique to recanalize one aberrant branch off the aneurysm sac.<sup>14-16</sup> Two case reports with multiple aberrant branches combined PGT with EVAR exclusion and described periscope and sandwich techniques.<sup>17,18</sup> In this case, the patient's proximal location of the branches precluded deploying a right-sided limb into the CIA with chimney reconstruction. Two cases reported type II endoleaks that did not require intervention.<sup>14,15</sup> One case report, from Sakai et al,<sup>7</sup> had similar ectopic renal artery anatomy to this case, except the left pelvic renal artery arose from the distal CIA.<sup>7</sup> They preserved the distal left pelvic renal artery and covered the origin of the right with standard EVAR.<sup>7</sup>

Compared with the available case reports that describe PGT, this case raises two important anatomical considerations for treating concurrent AAA and CPK in patients unfit for open repair. First, the presence of two 4-mm renal arteries that contributed 30% of renal function and the patient's preexisting CKD precluded intentional



**Fig 2.** Computed tomography angiogram (A) and Terarecon three-dimensional reconstruction (B). One-month postoperative imaging demonstrating patent hybrid repair: bifurcated aortic endograft and parallel grafting to revascularize the pelvic renal arteries through the contralateral gate combined with a right common iliac endovascular occlusion and femoral-femoral bypass.

coverage of one or both pelvic renal arteries. Second, owing to the pelvic renal arteries arising from the right and left CIA and owing to their proximal location, a modified PGT was needed to revascularize the CPK and ensure endoseal. This technique had both renal stents parallel to each other within the contralateral gate rather than parallel to an endoprosthesis limb as is typically seen with other PGTs. This approach necessitated occlusion of the right CIA and femoral-femoral bypass. The main limitation of this case report is that, owing to patient death, there is no long-term follow-up.

## CONCLUSIONS

This case describes an alternative approach for hybrid repair of infrarenal AAA in the setting of CPK. As there is significant variability in renal vasculature in patients with ectopic kidneys, techniques for repair of aneurysmal disease in this patient population must be individualized based on anatomy and medical comorbidities.

## ETHICS STATEMENT

The patient has consented to publication of their case and images.

## FUNDING

None.

## DISCLOSURES

K.R. is a consultant and speaker for W. L. Gore & Associates.

## REFERENCES

1. Cinman NM, Okeke Z, Smith AD. Pelvic kidney: associated diseases and treatment. *J Endourol.* 2007;21:836–842.
2. Faggioli G, Freyrie A, Pilato A, et al. Renal anomalies in aortic surgery: contemporary results. *Surgery.* 2003;133:641–646.
3. Papadoulas S, Kouri N, Tsimpoukis A, et al. Endovascular repair of an inflammatory abdominal aortic aneurysm combined with a congenital pelvic kidney: case report and literature review. *Aorta (Stamford).* 2022;10:135–140.
4. Oderich GS, Forbes TL, Chaer R, et al. Reporting standards for endovascular aortic repair of aneurysms involving the renal-mesenteric arteries. *J Vasc Surg.* 2021;73:4S–52S.
5. Romeo Thierry YT, Rita O, Behyamet O, Laila J, Fatima Zahra L. Ectopic kidney vascularization. *Oxf Med Case Reports.* 2022;2022:omac135.
6. Kaplan DB, Kwon CC, Marin ML, Hollier LH. Endovascular repair of abdominal aortic aneurysms in patients with congenital renal vascular anomalies. *J Vasc Surg.* 1999;30:407–416.
7. Sakai K, Watanabe T, Yoshida T. Endovascular repair for abdominal aortic aneurysm with an ectopic pelvic kidney: case report and procedural consideration of the aberrant renal artery. *World J Cardiovasc Surg.* 2018;8:111–116.
8. Edwards JB, Wooster MD, Tanious A, Back MR. Management of aortoiliac aneurysms with atypical renal artery anatomy. *Ann Vasc Surg.* 2019;54:110–117.
9. Wanhainen A, Van Herzele I, Bastos Goncalves F, et al. Editor's choice - European Society for Vascular Surgery (ESVS) 2024 clinical practice guidelines on the management of abdominal aorto-iliac artery aneurysms. *Eur J Vasc Endovasc Surg.* 2024;67:192–331.
10. Morales JP, Greenberg RK. Customised stent graft for complex thoraco-abdominal aneurysm associated with congenital pelvic kidney. *Eur J Vasc Endovasc Surg.* 2009;37:557–559.
11. Majumder B, Perera AH, Browning N, MacGregor M, Chapman A. Fenestrated endograft as a new perspective for the treatment of infrarenal abdominal aortic aneurysm with a congenital pelvic kidney—a case report and review of literature. *Ann Vasc Surg.* 2017;45:266.e1–266.e4.
12. Donas KP, Lee JT, Lachat M, Torsello G, Veith FJ. Collected world experience about the performance of the snorkel/chimney

endovascular technique in the treatment of complex aortic pathologies: the PERICLES registry. *Ann Surg*. 2015;262:546–553. discussion: 52-3.

13. Greenberg RK, Clair D, Srivastava S, et al. Should patients with challenging anatomy be offered endovascular aneurysm repair? *J Vasc Surg*. 2003;38:990–996.
14. Kfoury E, Almanfi A, Dougherty KG, Krajcer Z. Endovascular abdominal aortic aneurysm repair by means of the chimney technique in a patient with crossed fused renal ectopia. *Tex Heart Inst J*. 2016;43:232–235.
15. Ertugay S, Posacioglu H, Bozkaya H, Parildar M. Chimney technique for solitary pelvic kidney. *Interact Cardiovasc Thorac Surg*. 2020;31: 743–744.
16. Colacchio EC, Coggia M, Salcuni M, Giorgio D, De Robertis G, Colacchio G. Endovascular repair of an abdominal aortic aneurysm

associated with crossed fused renal ectopia. *J Vasc Surg Cases Innov Tech*. 2020;6:140–142.

17. Kawatani Y, Yamasaki M, Oguri A. Endovascular aortic aneurysm repair with reversed chimney graft technique in a patient with crossed fused renal ectopia: a technical note. *J Surg Case Rep*. 2021;2021:rjab272.
18. Zhang Z, Ye J, Fu T, Li Z. Chimney stent graft technique for endovascular repair of penetrating atherosclerotic ulcers of abdominal Aorta with bilateral common iliac artery aneurysms and ectopic right renal artery Stenosis. *Ann Vasc Surg*. 2020;62:499. e9–499.e14.

Submitted Oct 2, 2024; accepted Dec 2, 2024.