

## CASE REPORT

## Endovascular Repair of a Chronic AV Fistula Presenting as Post-Partum High Output Heart Failure

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**Introduction:** Acute injury to the large vessels is the most feared of diagnoses for a spinal surgeon, but far more common is the delayed presentation of arteriovenous fistula (AVF) formation. The mean time to diagnosis of an AV fistula in this scenario is just over 1 month. Treatment can include both open and endovascular repair.

**Report:** This study presents a case of an otherwise healthy 39-year-old woman who initially presented with orthopnea, leg edema, and a presumptive diagnosis of post-partum cardiomyopathy. Cardiac investigations revealed high output cardiac failure and an abdominal CT scan confirmed an arterial venous fistula from the left common iliac artery to left common iliac vein. The patient maintained a cardiac output three times normal prior to her definitive treatment. This high flow physiology caused unique challenges for the endovascular procedure as the stent graft collapsed and distorted toward the iliac side wall. The AV fistula was eventually covered successfully and post-operative studies show no further fistula and normal cardiac function. This case demonstrates an unanticipated effect of very high flows of stent graft deployment.

**Discussion:** Extreme high flow AV fistulas can present as unexpected challenges to endovascular repair. These issues may be ameliorated by techniques such as controlled hypotension, adenosine, ventricular pacing, or proximal balloon occlusion.

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### INTRODUCTION

Vascular injury after posterior surgery to the lumbar spine is well documented with a reported incidence of approximately 1–5 in 10,000.<sup>1</sup> Acute injury to the large vessels is the most feared of diagnoses for a spinal surgeon but far more common is the delayed presentation of arteriovenous (AV) fistula formation. Such injuries are known to account for approximately two-thirds of all iatrogenic vascular injuries post lumbar discectomy.<sup>1,2</sup> This is in contrast to true isolated vessel lacerations which account for roughly 30–34% of all injuries.<sup>1,2</sup>

The mean time to diagnosis of an AV fistula in this scenario is just over 1 month; however, there are reports of discovery up to 11 years post operation.<sup>1</sup>

This study presents a case of an AV fistula 12 years after lumbar discectomy that manifested as post-partum high output heart failure (HOHF).

### CASE REPORT

A 39-year-old female was admitted 7 days after emergent Caesarean section for failed induction with a 1-day history of bright red blood per rectum and mild abdominal discomfort.

On further questioning, she revealed that since her Caesarean section she had been having symptoms of orthopnea and worsening pedal edema up to her waist. She did not have any dyspnea on exertion.

On examination, her abdomen was benign but her bowel sounds were masked by a loud bruit that she commented had been present for approximately 10 years. Previous investigations had not resulted in a diagnosis. Her cardiovascular examination revealed tachycardia (HR 112) and a BP of 156/60. On auscultation, a murmur was heard radiating throughout the precordium and through to her back. Her lungs were clear to auscultation. She was noted to have marked pedal edema to the waist.

Chest X-ray showed cardiomegaly, shallow pleural effusions, and signs of cardiogenic pulmonary edema (Fig. 1).

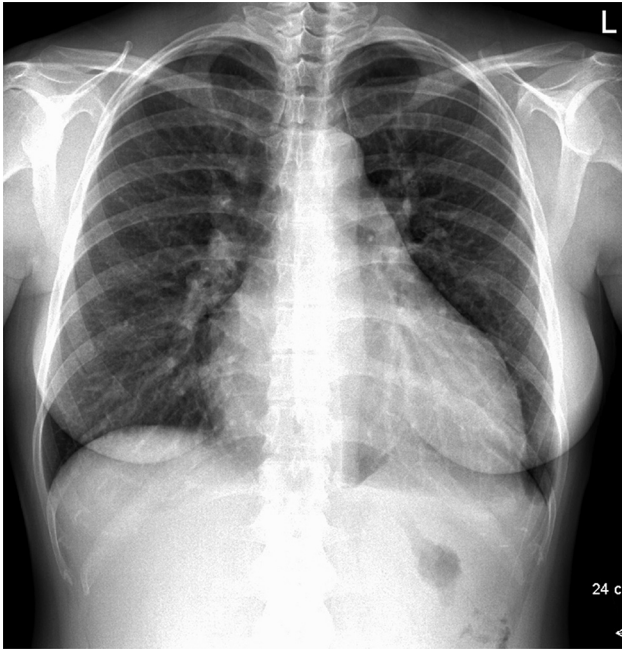
A CT scan was ordered for assessment of the gastrointestinal bleed. It showed marked dilation of the inferior vena cava (IVC), hepatomegaly with congestion, and enlargement of the hepatic veins. Numerous dilated uterine and pelvic veins were also noted and attributed to her

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**Figure 1.** CXR revealing cardiomegaly and pulmonary redistribution consistent with pulmonary edema.

status post-partum. The conclusion from the CT scan was that these findings were consistent with a post-partum cardiomyopathy.

She underwent upper and lower gastrointestinal endoscopy in search of a cause of her GI bleeding. The colonoscopy was significant for hemorrhoids at the anal verge and rectal polyp, which was biopsied as benign. The bleeding per rectum was assumed to be hemorrhoidal in nature secondary to venous congestion.

An echocardiogram was performed and showed that she indeed had a marked cardiomyopathy. Her left ventricle (LV) was moderately dilated with severe eccentric LV hypertrophy (LV end-diastolic dimension 6.7 cm). The index LV dimension was 3.9 cm/m<sup>2</sup>, which was in keeping with severe left ventricular enlargement. Her LV ejection fraction was 67%. She had severe biatrial enlargement (left atrial volume index of 75 mL/m<sup>2</sup>) with mild mitral and tricuspid valve regurgitation. There was moderate pulmonary artery hypertension with a pulmonary artery pressure of 57 mmHg. Her calculated cardiac output was 14.5 L/min giving an elevated cardiac index of 8.5 L/min/m<sup>2</sup>, almost three times the normal value.

The findings of a significantly elevated cardiac index with a normal ejection fraction on echocardiography as well as her physical examination suggested that she had had a high output cardiac state for a number of years.

After investigating for other causes of HOHF, her abdominal CT scan was re-visited by a vascular surgeon who diagnosed her with a left common iliac artery to left common iliac vein AV fistula (Fig. 2).

Surgical intervention was discussed with the patient and consideration was given to an open versus endovascular procedure. Informed consent was obtained for endovascular repair of her AV fistula.



**Figure 2.** CT angiogram demonstrating dilated IVC and pelvic vasculature as well as a communication between the left common iliac artery and vein.

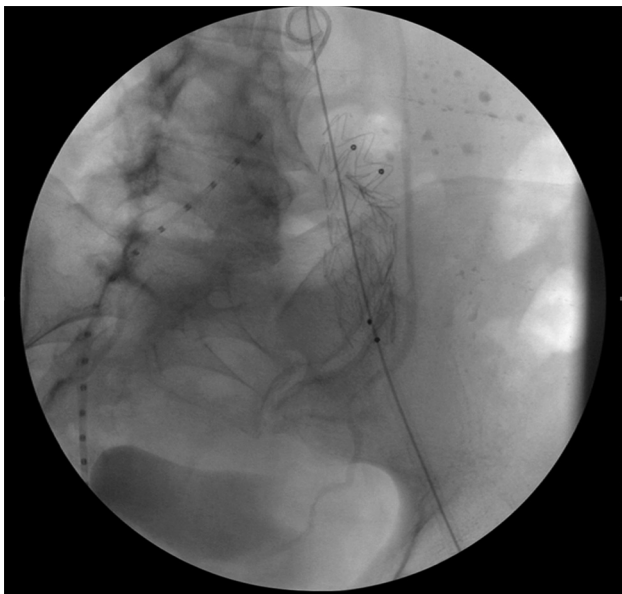
### **Endovascular procedure**

The patient underwent a non-urgent endovascular repair of her AV fistula under spinal anesthesia. A Medtronic Endurant iliac stent (ENLW 2424C80) was delivered up the left common iliac artery. As it was unsheathed, the high arterial flow collapsed the proximal stent such that the proximal portion was bent perpendicular to the long axis of the vessel. It was possible to deploy the remainder of the graft and shorten it to just above the iliac bifurcation. Post-deployment angiogram revealed that the AV fistula was covered but the opening of the proximal graft was essentially facing the sidewall (Fig. 3). An additional Medtronic Endurant iliac stent (ENLW 2424C80) was delivered to the aortic bifurcation and was easily deployed properly because at this point the flow through the fistula had been effectively blocked by the first stent, thus decreasing the flow rates. Subsequent imaging showed a good result with no endoleak and complete resolution of the AV fistula. The completion angiogram revealed a narrowing where the two stent grafts overlapped, which equated to a diameter of approximately 12 mm (40% narrowing). No balloon angioplasty was attempted for fear of perforating the iliac sidewall (Fig. 4).

Post-operative CT scan showed no residual fistula and mild stenosis of the iliac stent (Fig. 5). Echocardiogram in 1 month showed left ventricular ejection fraction at 61% cardiac output of 5.0 L/min and the cardiac index at 3.1 L/min/m<sup>2</sup>.

### **DISCUSSION**

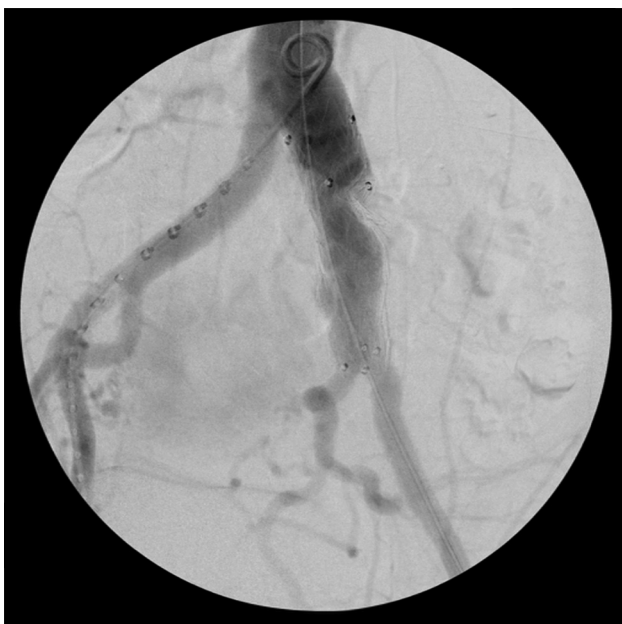
Vascular injury following lumbar disc surgery has been described; however, the presentation of such injuries varies significantly from life-threatening hemorrhages to chronic AV fistulas and pseudoaneurysms.<sup>3,4</sup> The majority of cases



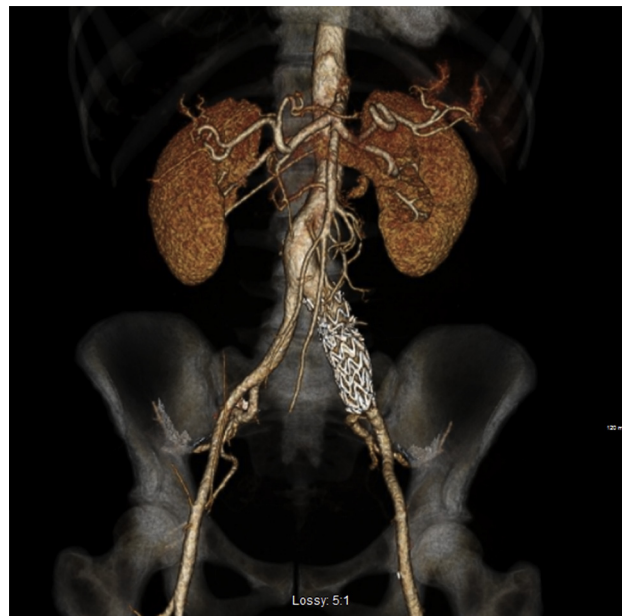
**Figure 3.** Intra-operative fluoroscopic view demonstrating the proximal end of the stent graft oriented at the lateral wall of the common iliac artery.

reported in the literature describe a presentation within the first year following lumbar surgery. However, delayed presentations up to 11 years have been reported.<sup>1</sup>

The actual symptomatology of the presentations is as heterogeneous as their time course. A brief review of published cases of AV fistula following lumbar disc surgery highlights that presentations are varied. HOHF is one presentation but tended to be an earlier and more dramatic presentation.<sup>5–7</sup> Other presentations include abdominal



**Figure 4.** Final intra-operative angiogram demonstrating the two overlapping stents. Note the stenotic area (12 mm) at the junction of the proximal and middle third of the grafts, which was inconsequential clinically and on follow-up lower limb flow studies.



**Figure 5.** 3D reconstruction of arterial phase, 1-month post stent graft insertion. No AV fistula seen, mild stent stenosis.

pain and distension, claudication, and, very commonly, leg swelling.<sup>5,8</sup> In the present case, the patient had complained only of a very loud bruit to her family practitioner whose investigations years earlier had not revealed any pathology. The patient had come to live with the “purring” in her abdomen; even her family and friends commented on her “buzzing” when she was near.

Prior to her pregnancy she had been fit and healthy, exercising regularly running several times a week. However, it was the physiology associated with pregnancy that eventually caused her to tip into overt heart failure. Pregnancy in itself is a high output state with overall blood volume and cardiac output being increased by 30–50% and given the patient’s predisposition, her decompensation in the third trimester and post-partum, in retrospect, is not surprising.

McCarter et al. first reported the endovascular treatment of an AV fistula following lumbar disc surgery in 1996.<sup>5</sup> Since that time there have been multiple case reports of endovascular repair of such injuries, and recently a number of authors have ventured that endovascular repair should be the first-line treatment in this scenario.<sup>6</sup> The present authors concur, as an endovascular approach intuitively reduces the morbidity associated with an open repair, and allows for quicker recovery and shorter hospital stays.

Despite these advantages, special precaution during deployment must be considered for this high cardiac output state. Consideration of reducing elevated flows in high output fistulas before deployment seems appropriate considering the findings in this case. This could include measures such as controlled hypotension, administration of adenosine heart block, intraventricular pacing, or proximal balloon occlusion. Grafts that remain partially constricted until complete unsheathing, could also be considered in these high flow states, if measuring parameters allow.

### Conclusion

A case is presented of an endovascular repair of a high flow iliac artery to iliac vein fistula secondary to an iatrogenic lumbar discectomy arterial injury 12 years previously. The otherwise healthy patient presented as post-partum cardiac failure. The high flow AV fistula presented challenges for endovascular treatment as the elevated iliac flows severely distorted the stent graft during deployment. Once the AV fistula was contained a further stent deployment proceeded without incident, with normalization of physiologic parameters 1 month post operatively.

### CONFLICT OF INTEREST

None.

### FUNDING

None.

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