

1 Spontaneous Aortocaval Fistula Associated with Ruptured 2 Abdominal Aortic Aneurysm-Unique Endovascular Repair

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6 **Abstract**

7 Aortocaval fistula (ACF) is a rare complication associated with abdominal aortic aneurysm.
8 Open repair of this entity is well described in the literature. Less well described are
9 endovascular means for repair as well as mid and long term outcomes. We describe a case of a
10 ruptured abdominal aortic aneurysm that presented with an aortocaval fistula and was
11 managed with endovascular interventions on both the aorta and inferior vena cava. Following
12 placement of an aortic stent graft, there was persistent flow through the ACF and a large
13 Type I endoleak. Subsequent management included placement of second bifurcated stent graft
14 in the inferior vena cava. No further endoleaks were encountered. To our knowledge, this is a
15 unique management of a rare complication of aortic aneurysm rupture with fully endovascular
16 exclusion of ACF.

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18 **Index terms**— aortocaval fistula, endovascular repair, abdominal aortic aneurysm, inferior vena cava, type
19 ii endoleak.

20 **1 I. Introduction**

21 spontaneous aortocaval fistula (ACF) was described first by Syme in 1831, complicating a syphilitic aneurysm. It
22 is a rare entity, associated with 1% -4% of ruptured abdominal aortic aneurysms (AAA). The classic presentation
23 of an ACF includes high-output cardiac failure, a palpable pulsatile abdominal mass and a machinery bruit. The
24 presence of all of these symptoms occurs in only 20-50% of patients. Successful treatment of ACF by both open
25 and endovascular methods has been reported, with mortality rates as high as 60% for the former and a paucity
26 of data for the latter³. There are no reported cases in which stent grafts were used to treat both the arterial and
27 venous components of an ACF.

28 **2 II. Case Presentation**

29 A 61-year-old male was transferred to the Emergency Room from an outside hospital with a known ruptured
30 AAA.

31 Upon arrival, he was hypotensive complaining of severe abdominal pain radiating to the back with new-onset
32 paresthesia of his bilateral lower Extremities. The duration of symptoms was approximately two hours before
33 evaluation in our institution. The patient was not in congestive heart failure. A CT Angiogram of the abdomen
34 and pelvis was obtained and revealed a ruptured 7.5cm infrarenal AAA with contrast extravasations into the
35 retro peritoneum. There was a significant contrast enhancement of the inferior vena cava (IVC) suggesting the
36 presence of ACF (Fig ??). The aneurysm neck was highly angulated and approximately 12mm long. The patient
37 was taken to our hybrid operating room (OR) for further treatment. Wire access was obtained through bilateral
38 femoral artery cut-downs, and a Medtronic 26mm Talent main body device with AneuRxiliac limbs was placed
39 with preservation of both hypo gastric arteries. Aortography revealed a large Type I end leak (EL) and persistent
40 ACF (Fig 2, Fig 3). A large Palmaz stent was mal-deployed at the neck and was, therefore, moved proximally
41 and fully deployed in the thoracic aorta. A second well deployed Palmaz stent failed to completely resolve the
42 Type I EL as did placement of a proximal aortic cuff with intentional coverage of the left renal artery. The
43 femoral veins were cannulated, and a large compliant balloon was inflated in the IVC to occlude the ACF with

3 III. DISCUSSION

44 a resultant significant decrease in the Type I EL suggesting that closing the fistula by placing a stent graft
45 within the inferior vena cava (IVC) at the bifurcation might resolve the large end leak. A sufficiently large stent
46 graft was not available at the time so the patient was transferred to the ICU where he remained stable until he
47 returned to the operating room on the second post-operative day. The ACF was excluded by a deployment of a
48 Gore TAG device within the IVC followed by placement of bilateral iliac vein reversed Gore 16x20 limbs (Fig 4).
49 Aortography demonstrated a small Type III end leak which was not treated at this point.

50 In the ensuing days, however, the patient's hematocrit decreased and a repeat CTA showed the retroperitoneal
51 pseudo aneurysm and aneurysm to have significantly increased in size, a recurrent ACF and both large Type I
52 and III endoleaks and a right femoral DVT. The patient returned to the OR for possible endovascular or open
53 aneurysm repair. During surgery, the left and right iliac stent grafts were relined with Gore excluder limbs,
54 the Palmaz stent was once again repositioned into the thoracic aorta, and the proximal aortic stent graft was
55 re-balloon with a noncompliant balloon. All endoleaks were now resolved as was the ACF (Fig ??). An IVC
56 filter was also placed. After this procedure, the patient's post-operative course was uncomplicated and discharged
57 home in good condition. At four year follow-up, the patient's aneurysm remains excluded with continued sac
58 shrinkage and no evidence of an ACF.

59 3 III. Discussion

60 The pre -operative diagnosis of spontaneous ACF is crucial when planning AAA repair both in elective and
61 emergency cases. Before endovascular techniques, ACF represented an unwelcome challenge to the vascular
62 surgeon who attempted the open repair. The most common method used was over-sewing the fistula from within
63 an opened aneurysm sack, but this is associated with significant blood loss and high mortality, even in elective
64 cases 4,5,6 .

65 The first description of the use of endovascular stent grafts in the treatment of arteriovenous fistulas was
66 described by Boudghene et al. in an experimental study on a sheep model, where fistulas were created
67 percutaneously 7 . This study was followed by a published case series by Juan C. ??arodi 8 , in which he
68 described the successful use of endovascular techniques for treatment in patients with arteriovenous fistulas as a
69 result of a traumatic injury. The first use of endovascular exclusion for the treatment of ACF associated with AAA
70 was described by Beveridge et al in 19989, and was followed by several similar reports [8][9][10][11][12][13][14] .
71 In all of these cases, implantation of an aortic stent graft proved adequate to resolve the ACF, and none of the
72 patients were reported to require further treatment.

73 Cases in which placement of an aortic stent graft does not resolve an ACF remain a challenge for
74 vascular surgeons. There have been three reports in the literature describing the use of Amplatzer plugs
75 to occlude unresolved fistulas after aortic stent graft placement. [15][16][17] and one, describing the use of
76 EmbikrilatBrauhistoacrylic gel 18 . In another report, a covered tubular stent graft, deployed in the IVC, was
77 used to successfully treat a persistent ACF manifesting as a type II endoleak in a patient who had endovascular
78 treatment of ruptured abdominal aortic aneurysm six months prior 19 .

79 Our patient had a preoperative diagnosis of a large aneurysm which had ruptured both into the IVC and
80 into the retro peritoneum. Despite repair of the aortic rupture with a stent graft and additional procedures
81 including a Palmaz stent and a proximal aortic cuff, there remained a large type Iaendoleak and ACF. Placement
82 of a bifurcated aortic stent graft within the IVC to completely cover the ACF ultimately resolved the type
83 Iaendoleak and the ACF. A possible theory for why this succeeded is that the presence of a large ACF behaved
84 as a large, low pressure outflow sump making adequate sealing of the aortic stent graft impossible. With the
85 closure of the venous portion of the ACF, the outflow transitioned to a high -resistance system, which eventually
86 led to thrombosis of fistula and resolution of endoleak. Wang et al described their experience with three cases
87 of endovascular repair of ACF with hostile aortic anatomy. In all cases only aortic repair was performed and
88 two out of three patients suffered from early type 1 or 3 endoleak requiring reintervention 20 . Although there
89 are anecdotal reports of successful endovascular treatment of aortic rupture with ACF by placement of an aortic
90 stent graft alone, the size of the ACF is not described nor is the quality of the proximal aortic neck. In our case
91 the ACF was large and the proximal aortic neck highly angulated and short, making it difficult to manage with
92 only one stent-graft exclusion.

93 End luminal stent-graft repair of IVC and other vein injuries have been previously described, mainly for
94 treatment of traumatic injuries 21 . No long-term results for these treatments have thus far been reported
95 in the literature. Silveira et al described similar repair of ACF with coverage of the venous portion of the
96 fistula with a stent graft cuff from the venous access22. Similarly, Elk assaby et al described two cases with a
97 simultaneous deployment of aortic and IVC stent grafts to exclude ACF in two patients with ruptured AAA with
98 good shortterm results. 23 In our case, the midterm result has proved to be excellent and we will continue to
99 monitor this patient for long-term treatment durability.

100 Clearly, despite our good result, further reports of similar treatments are necessary before any relevant
101 conclusions or recommendations can be made for this uncommon entity.

102 4 IV. Conclusion

103 Although aortocaval fistula, as a complication of a ruptured aortic aneurysm, remains a challenge in surgical
104 management, endovascular treatment of such condition is feasible but may require both aortic and caval
interventions for ultimate success. ¹



Figure 1: Fig. 1 :Fig. 2 :Fig. 3 :Fig. 4 :Fig. 5 :

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Figure 2:



Figure 3:

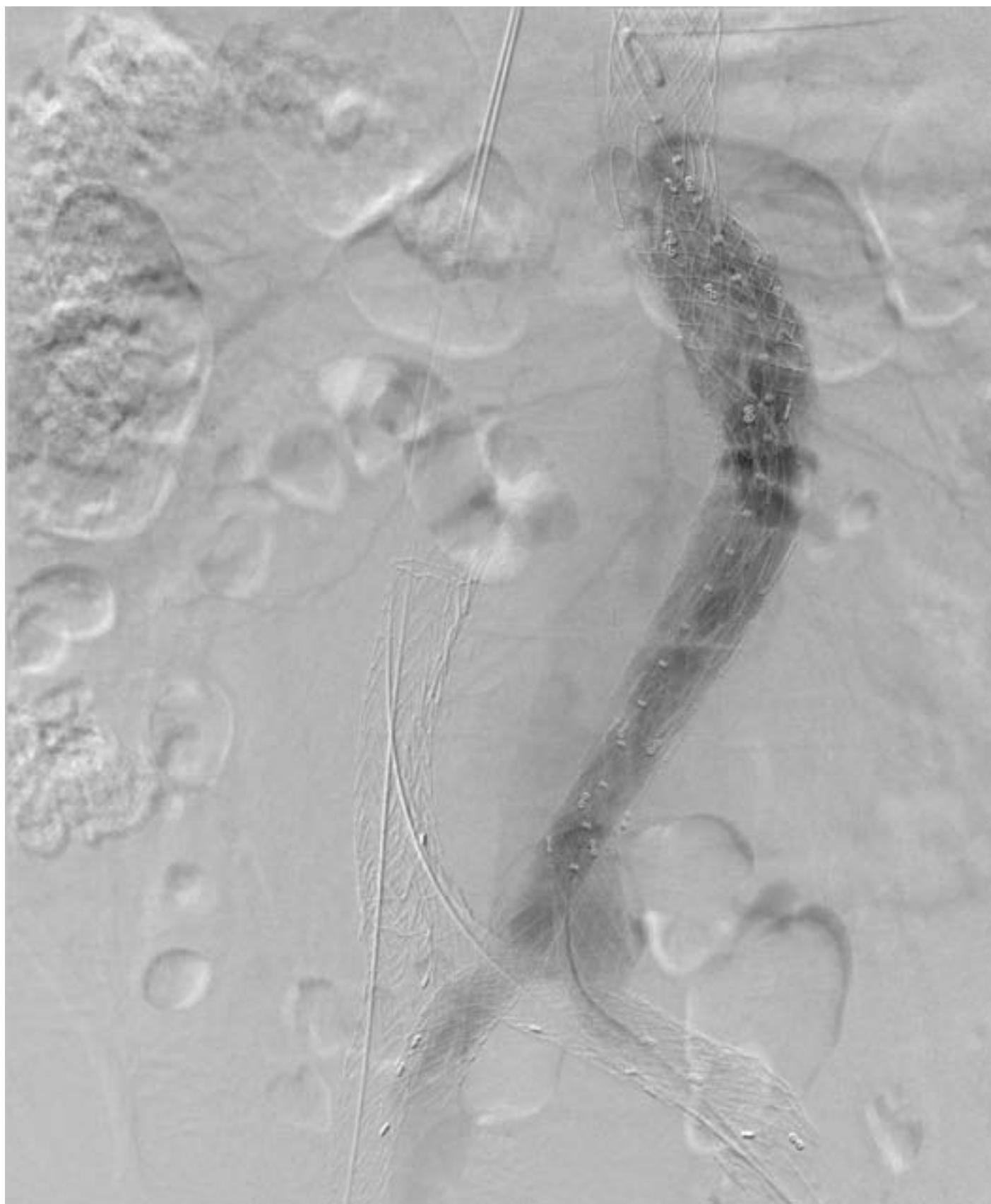


Figure 4:

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