

# Delayed abdominal aortic aneurysm sac rupture after open repair

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## ABSTRACT

Open surgical repair of abdominal aortic aneurysm (AAA) is often regarded as a near-permanent operation with little long-term complications. Reported herein is a case of delayed rupture of an enlarging AAA sac after open repair requiring re-exploration in a patient presenting with flank pain and ipsilateral hydronephrosis. The natural history of a large, excluded aneurysm sac after open AAA repair, hypothesized etiology for this rare occurrence, and proposed diagnostic and therapeutic algorithm are described. (J Vasc Surg Cases Innov Tech 2024;10:101552.)

**Keywords:** Abdominal aortic aneurysm repair; Open aneurysmectomy; Reintervention; Sac

First described in the 1950s, open repair of abdominal aortic aneurysm (AAA) using an interposition graft has enjoyed decades of data and proven to be a durable repair.<sup>1-3</sup> Late reoperation after open AAA repair is, indeed, rare, and more commonly driven by incisional morbidity than late aneurysmal complications.<sup>4</sup> These satisfactory results have been demonstrated not only in large retrospective clinical studies but also in randomized controlled trials comparing endovascular with open AAA repair.<sup>5,6</sup> Given its longevity, it is no surprise that the Society for Vascular Surgery recommends a non-contrast-enhanced computed tomography (CT) scan dispersed at 5-year intervals after open AAA repair.<sup>7</sup>

This case report describes a rare occurrence of delayed aneurysm sac enlargement after contained rupture of an excluded AAA sac following an open repair. Potential mechanisms for this infrequent complication, its work-up and management, as well as their implications for the more commonly observed endotension phenomenon observed after endovascular abdominal aortic aneurysm repair are detailed herein. The patient provided publication consent for this manuscript.

## CASE REPORT

A 74-year-old Asian male with hypertension, hypercholesterolemia, diabetes mellitus, atrial fibrillation on Rivaroxaban, coronary

artery disease status post coronary artery bypass grafting and prior left hemicolectomy for polyp presented with left flank pain after falling on his left side. Eight years prior, the patient had undergone elective open repair of a 5.5-cm asymptomatic AAA and right common iliac aneurysm using a 16 × 9 mm polytetrafluoroethylene (PTFE) aorto-bi-iliac graft with reimplantation of the inferior mesenteric artery onto its left iliac limb. The operative note included the statement that, “the aneurysm sac was then closed over the graft, and then retroperitoneum was closed with running Vicryl suture.”

On physical examination, the patient was awake and alert. His physical exam was remarkable for left flank ecchymosis along with a large midline firm but non-pulsatile abdominal mass, and intact distal pulses. Review of prior images revealed an abdominal CT scan from 1 year prior showing an intact, retained aneurysm sac surrounding a patent aorto-bi-iliac graft (Fig 1, A). Repeat CT revealed that the sac had now ruptured into the left retroperitoneum (Fig 1, B).

The patient remained hemodynamically stable. He was admitted to the hospital and advised to undergo abdominal exploration. However, as his symptoms quickly resolved, he declined intervention and returned home.

Approximately 1 year later, the patient returned with persistent flank pain and an enlarging abdomen. Repeat CT revealed interval enlargement of the aneurysm sac now measuring 9 cm in diameter with new left hydronephrosis without renal failure (Fig 1, C). Physical examination revealed a protuberant abdomen with a firm but non-pulsatile mass (Fig 2). Subsequent contrast angiography revealed a patent aorto-bi-iliac graft (with reimplanted inferior mesenteric artery) without extravasation or late filling of the aneurysm sac (Fig 3). Within 48 hours, the patient was taken to the operating room. The old midline incision was reopened. No free fluid was encountered. The abdominal viscera were dissected free from the 20-cm retained aneurysm sac, which encompassed the entire retroperitoneum and left upper quadrant (Fig 4). After obtaining supra-celiac control through the lesser sac, the aneurysm sac was entered sharply. Serous fluid as well as thick, colloid, spongy material was noted, reminiscent of mural thrombus generally encountered during

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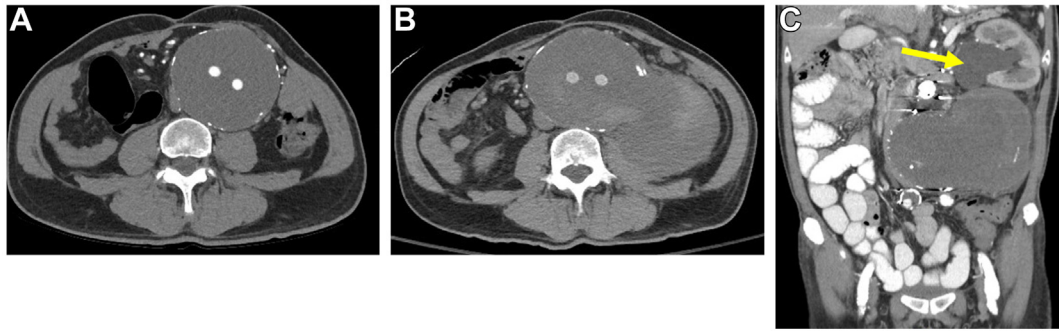
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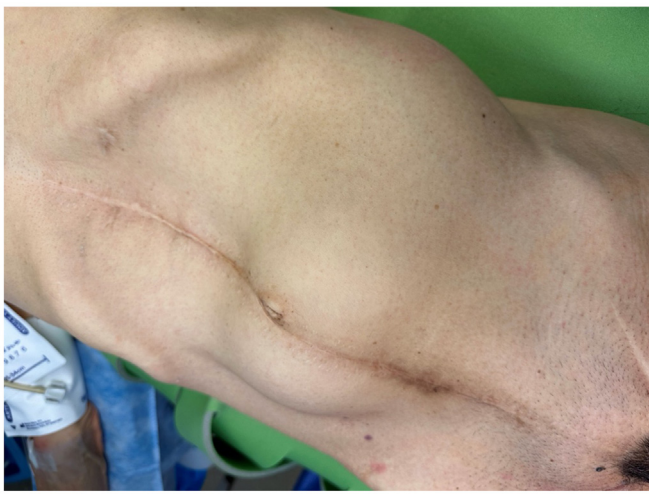
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**Fig 1.** Evolution of retained abdominal aortic aneurysm (AAA) sac on cross-sectional imaging. **A**, One year prior to index presentation. **B**, At index presentation. **C**, Before exploration. Note the left hydronephrosis indicated by the yellow arrow.



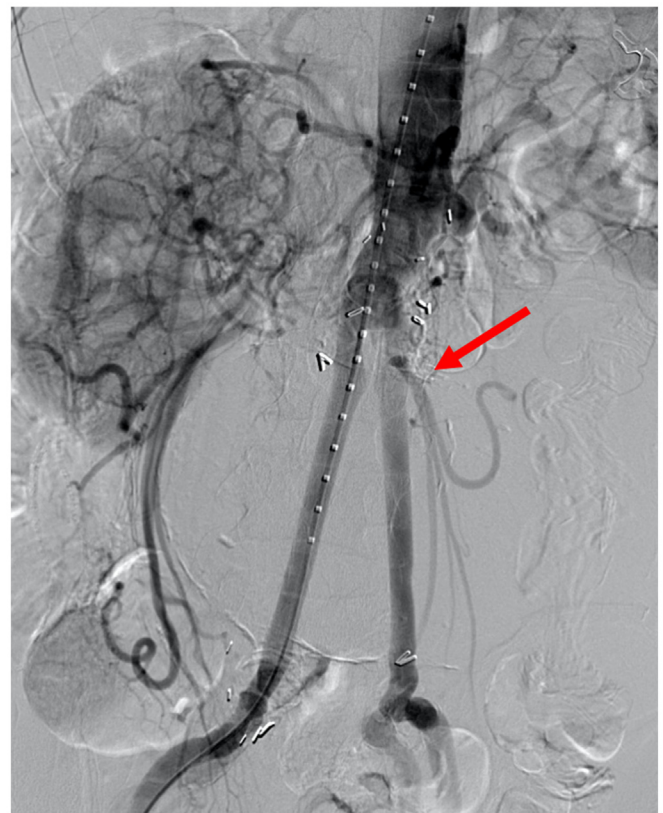
**Fig 2.** Preoperative abdominal exam demonstrating large abdominal mass.

routine open repair (Fig 5). There was no evidence of infection, and no active bleeding, notably no bleeding from any lumbar arteries or other branches. The intact and pulsatile aorto-bi-iliac graft was identified in the sac and left undisturbed. After evacuation of the sac contents and irrigation, a large portion of the aneurysm's anterior wall was excised sharply. The attenuated sac was then reclosed over the aortic graft.

The patient's postoperative course was complicated by persistent ileus, but he was eventually discharged to a rehabilitation facility after 2 weeks. Pathologic examination of the aneurysm sac contents revealed only fibrin and blood.

## DISCUSSION

The phenomenon of endotension, defined by Gilling-Smith et al as "persistent or recurrent pressurization of aneurysm sac following endovascular repair," is only rarely observed after open aneurysmectomy.<sup>8</sup> In 2005, May et al commented in the *Journal of Vascular Surgery* that, perhaps, "persistent or recurrent pressurization of an aneurysm sac without endoleak that follows an



**Fig 3.** Digital subtraction angiography demonstrating intact repair with patent inferior mesenteric artery (red arrow).

endovascular or open aneurysm repair" constituted a better definition for this singular finding.<sup>9</sup> The controversy in defining this clinical entity lies not only with its terminology and whether it should be ubiquitously applied to open reconstructions, but also to its sequelae and management.<sup>10</sup> Clinical work-up should probably include, in addition to high-quality fine-cut cross-sectional and contrast-enhanced imaging, a formal digital subtraction angiogram to rule out an anastomotic leak or an "endoleak."<sup>11,12</sup> Nevertheless, aneurysm sac



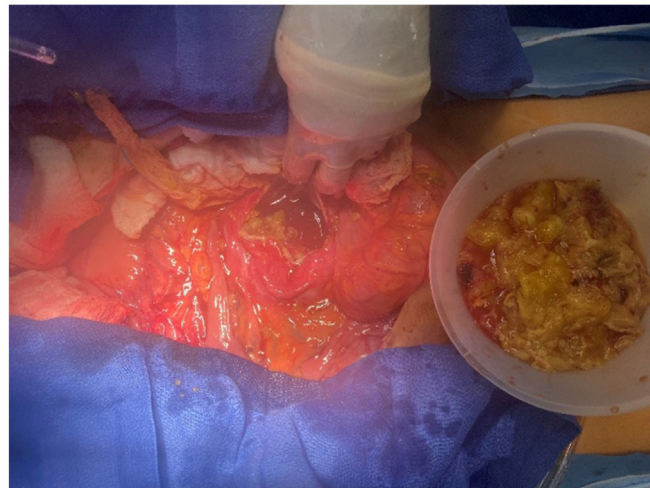


**Fig 4.** Intraoperative intact large, retained aneurysm sac.

expansion may occur even without evidence of endoleak on various imaging modalities. In this case, for example, these studies demonstrated a patent reconstruction without contrast extravasation. Operative exploratory confirmed the absence of an occult endoleak.

This patient's long-term course was marked by a large, retained aneurysm sac after open AAA repair complicated by retroperitoneal contained rupture and ongoing expansion. Although the patient's fall might have led to sac rupture, endotension has been linked to spontaneous retroperitoneal sac rupture after open repair.<sup>13</sup> Thought of as typically benign, endotension can generally be observed without consequences.<sup>14</sup> In this case, progressive and unremitting aneurysm sac enlargement leading to hydronephrosis prompted additional work-up (formal angiography) as well as operative intervention to alleviate symptoms and prevent irreversible kidney function impairment. Sac excision was favored over morbid revisional aortic surgery with an alternate conduit (Dacron in lieu of the implanted PTFE) after ruling out an occult leak.

The hypothesized mechanisms for aneurysm sac enlargement after open exclusion include the accumulation of fluid exudate from the thickened sac wall and vasa vasorum and local enzymatic activity.<sup>15-17</sup> In a



**Fig 5.** Aneurysm sac contents.

retrospective study of 419 patients undergoing open AAA repair, perigraft seroma was noted on postoperative imaging in only 20 patients. The majority of them had undergone previous repair using PTFE. Among these, only three required reoperation for symptomatic sac expansion. These were managed by open exploration, sac evacuation, and partial or complete graft replacement.<sup>18</sup> Fenestration, sac resection/reduction, wrapping, and percutaneous aspiration and drainage have also been described with disparate results.<sup>19</sup> Acute and subacute recurrences are common.<sup>20</sup> Postoperative surveillance with routine ultrasound or CT could be envisioned at close intervals in this select patient population for the early diagnosis and treatment of recalcitrant perigraft seromas and to prevent future rupture, extrinsic compression, and post-renal kidney injury.

Kadakol et al identified diabetes, anticoagulation, bifurcated graft reconstruction, and a left flank retroperitoneal approach as independent risk factors for this rare complication.<sup>18</sup> This patient exhibit two of these independent risk factors: having undergone a bifurcated reconstruction (odds ratio, 8.0; 95% confidence interval, 2.6-94.1;  $P = .017$ ), and being on anticoagulant (odds ratio, 7.2; 95% confidence interval, 2.6-63.3;  $P = .003$ ). In their cohort, the mean time of aneurysm sac enlargement detection was 51 months, with patients being diagnosed up to 156 months after their index operation, emphasizing the importance of long-term imaging follow-up after this invasive operation.

## CONCLUSION

In summary, aneurysm sac enlargement can rarely occur after open (and definitive) AAA repair. In instances where a large perigraft fluid collection is encountered, cross-sectional or digital subtraction contrast imaging may help determine whether a leak is present. The proposed indications for reoperation in this scenario are

patient symptoms and secondary organ sequelae (here, hydronephrosis). Patients presenting with this rare complication may benefit from closer post-revisional surgery surveillance than what is generally recommended to assess for degenerative changes of the remaining native aorta.

## DISCLOSURES

None.

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