

## Ruptured Abdominal Aortic Aneurysm in A Patient with A Retroaortic Left Renal Vein

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### Abstract

Retroaortic left renal vein is rare but life-threatening in abdominal aortic surgery. The risk of venous injury is especially high during surgery for a ruptured Abdominal Aortic Aneurysm (AAA). We report a case of ruptured AAA in an 84-year-old woman. Careful evaluation of the preoperative contrast-enhanced Computed Tomography (CT) images showed a retroaortic left renal vein and triple left renal arteries. The patient underwent successful surgical repair. Even in cases of ruptured AAA, preoperative contrast-enhanced CT should be performed to search for venous and arterial anomalies and reduce the risk of fatal bleeding when vital condition is not critical.

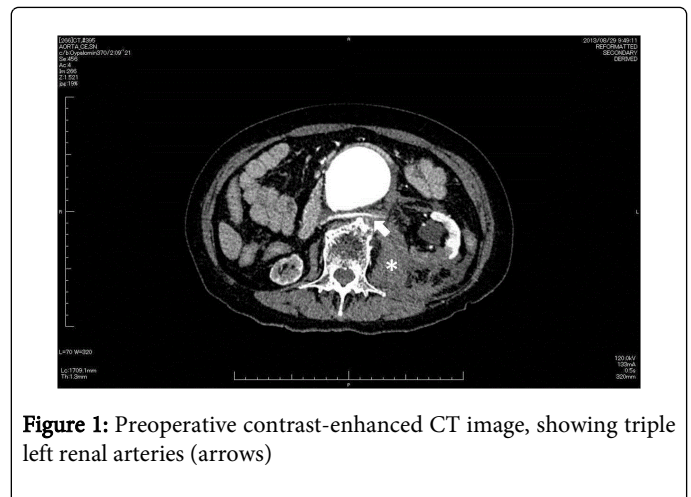
**Keywords:** Retroaortic left renal vein, Abdominal aortic aneurysm, Rupture

### Introduction

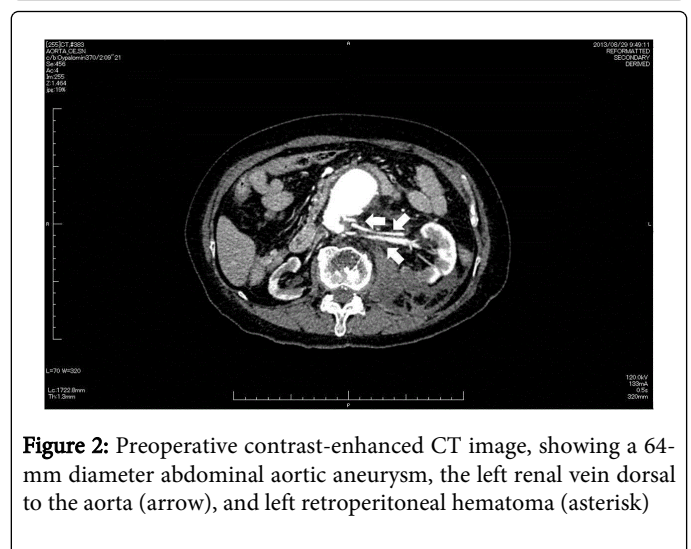
The surgical management of Abdominal Aortic Aneurysms (AAAs) is well established, and the most challenging intraoperative complication of this procedure is venous bleeding. A Retroaortic Left Renal Vein (RLRV) is an infrequent anomaly, with a reported incidence of 1.8 to 2.4% [1]. An RLRV is sometimes overlooked on the preoperative images, because surgeons are focused on evaluating the AAA. However, the presence of an RLRV makes it difficult to clamp the proximal neck of the AAA without injuring the venous structures. Injury to an RLRV may result in life-threatening bleeding. Therefore, accurate preoperative diagnosis of venous anomalies is an important aspect of minimizing the risks associated with abdominal aortic surgery. We report a case of ruptured AAA associated with an RLRV, in which accurate preoperative diagnosis was obtained by evaluation of contrast-enhanced Computed Tomography (CT) images.

### Case Report

An 84-year-old woman was referred to our hospital by ambulance because of severe lumbar pain. She was diagnosed with AAA at another hospital before. She was conscious and alert at admission with a blood pressure of 112/60 mmHg and a heart rate of 72 beats/min. Her hemoglobin level was 7.4 g/dL, serum creatinine level was 1.66 mg/dL, and estimated glomerular filtration rate was 23.1 mL/min/1.73 m<sup>2</sup>. No hematuria was detected. Ultrasound examination and contrast-enhanced CT showed a 64-mm diameter juxtarenal AAA, not extending below the bifurcation of the abdominal aorta. The AAA was adjacent to the lowest of three left renal arteries (Figure 1), an RLRV, and a left retroperitoneal hematoma (Figure 2). The inferior vena cava was in the normal position on the right side of the aorta.



**Figure 1:** Preoperative contrast-enhanced CT image, showing triple left renal arteries (arrows)



**Figure 2:** Preoperative contrast-enhanced CT image, showing a 64-mm diameter abdominal aortic aneurysm, the left renal vein dorsal to the aorta (arrow), and left retroperitoneal hematoma (asterisk)

Surgery was performed through a standard transperitoneal incision. The proximal portion of the AAA was carefully exposed, and absence of a left renal vein crossing ventral to the aorta was confirmed. The positions of the lowest left renal artery arising from the AAA and the RLRV were also confirmed. The abdominal aorta was carefully encircled with tape at the level of the RLRV. The proximal aorta was clamped transversely between the second and third left renal arteries to avoid injury to the RLRV. Graft replacement of the AAA was performed using a 20-mm tube graft (Intergard, Maquet, Hudson, USA). The ischemic time of the third left renal artery was 20 min. The inferior mesenteric artery was ligated. The patient had an uneventful postoperative recovery, and CT performed 2 weeks after the operation showed a surgically excluded retroaortic segment of the RLRV. She was doing well 1 year after the operation, with no exacerbation of the renal impairment.

## Discussion

The standardized operative techniques for abdominal aortic surgery result in acceptable mortality and morbidity rates for elective surgery. However, emergency surgery for a ruptured AAA is still challenging. Moreover, the time constraints associated with emergency AAA surgery often make it difficult for careful evaluation of the morphological characteristics of vessels other than the aneurysmal portion of the aorta.

The renal vein develops from a circumaortic venous ring, which is an anastomosis between the left and right subcardinal and supracardinal veins. Normally, the left renal vein forms ventral to the aorta after regression of the retroaortic component of the ring. If the venous ring persists, a circumaortic collar is formed. If the anterior limb of the ring regresses and the posterior limb persists, an RLRV is formed [2]. Major venous anomalies are rarely encountered in patients undergoing aortic surgery. Although left renal vein anomalies are rare [1], they substantially increase the risk of venous injury during surgery, because the lumbar and retroperitoneal veins often converge to form a fragile retroaortic venous network [3]. Brener et al. [1] reported that the RLRV was injured during operative dissection in more than 40% of patients with this anomaly, and that more than 20% of patients with an RLRV injury died as a result of bleeding.

Accurate preoperative diagnosis is an important aspect of preventing fatal bleeding from an RLRV. In patients with a ruptured AAA, the abdominal aorta should be reconstructed as soon as possible, because the conditions of such patients are often unstable. If an RLRV is not recognized, it can easily be injured when encircling the aorta or dissecting the posterior aortic wall. Careful evaluation of the preoperative CT images can therefore decrease fatal complications. The risk of venous injury is particularly high in cases of ruptured AAA because the border between the dorsal side of the abdominal aorta and the RLRV may be obscured by retroperitoneal hematoma. Techniques to reduce the risk of venous injury were previously reported [1-5]. Encircling of the aorta with a tape is not usually necessary. Clamping

of the proximal side of the AAA in a vertical direction is recommended, so that only the anterior and lateral sides of the neck of the AAA need to be dissected [3]. Hashizume et al. [4] recommended intraluminal anastomosis of the graft without dissecting the posterior wall. In our case, the proximal aorta was transected and the graft was carefully anastomosed to the posterior aortic wall with direct vision of the RLRV.

Recently, Endovascular Aneurysm Repair (EVAR) has been available even for ruptured AAA. In suitable cases, EVAR for ruptured AAA reduced hospital mortality compared with open repair [6]. EVAR must be the optimal treatment for AAA with a venous anomaly because surgical risk is the same. In our hospital, EVAR is not available for emergency cases, therefore, open repair was performed in the present case.

We performed preoperative contrast-enhanced CT even though our patient had poor renal function, because evaluation of CT images can provide valuable information [7]. Although magnetic resonance angiography without contrast agent could be the substitute for contrast-enhanced CT, it is still time-consuming.

In conclusion, we experienced a surgical case of ruptured juxtarenal AAA associated with an RLRV. The RLRV was diagnosed on preoperative contrast-enhanced CT, resulting in successful surgical repair of the AAA without injury to the RLRV or the third renal artery. Careful preoperative assessment to identify vascular anomalies is an important aspect for successful surgical repair. Even in cases of ruptured AAA, preoperative contrast-enhanced CT should be performed to enable detailed evaluation of the AAA as well as any venous or arterial anomalies when vital condition is not critical.

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