Life-Saving Embolization in a Patient with Recurrent Shock Due to a Type II Endoleak after Endovascular Aortic Repair for a Ruptured Abdominal Aneurysm

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A man in his 80s underwent urgent endovascular aortic repair (EVAR) for a ruptured abdominal aortic aneurysm (RAAA). Surgery was completed without apparent complications, and the patient was returned to the Cardiac Care Unit. Two hours later, he again developed shock, and contrast-enhanced Computed Tomography showed extravasation from a type II endoleak (T2EL) involving the IMA. Transcatheter arterial embolization (TAE) was immediately performed, and the patient’s vital signs stabilized soon after embolization. Abdominal compartment syndrome was suspected during the procedure, so a retroperitoneal hematoma evacuation was performed. The patient’s postoperative course was satisfactory, and he transferred to another hospital.

EVAR for RAAA would be useful, but it is necessary to be considered that T2EL can cause the aggravation of unstable circulation.

Keywords: ruptured abdominal aortic aneurysm, endovascular aortic repair, type II endoleak, transcatheter arterial embolization

Introduction

Ruptured abdominal aortic aneurysms (RAAAs) have a very poor prognosis, with 85% mortality rate.1 Even with surgical treatment, the early mortality rates are still high at 50%,2 and survival rates have not improved over the last 40 years with open surgery. Therefore, less-invasive endovascular aortic repair (EVAR) is promising and is increasingly indicated for treatment of RAAAs.

A patient in whom transcatheter arterial embolization (TAE) was a life-saving procedure for recurrent shock due to a type II endoleak (T2EL) after EVAR for an RAAA is described.

Case Report

A man in his 80s developed respiratory distress while sleeping. He was seen at our hospital emergency medical center, contrast-enhanced Computed Tomography (CECT) showed an RAAA, and urgent surgery was planned. Open surgery was deemed to be high risk because of the patient’s age, so a decision was made to perform EVAR.

On examination, the patient was alert and oriented, with blood pressure 86/27 mmHg, heart rate 59 bpm, and respiratory rate 27, with no cyanosis.

CECT showed an infrarenal aortic aneurysm with a maximum short diameter of 78 mm, extravasation from the right posterior aneurysmal wall into the retroperitoneum, and a large, right-sided retroperitoneal hematoma. The proximal neck diameter was 20 mm, the neck length was 38 mm, and there was aneurysmal dilatation (32 mm) of the left common iliac artery. No significant access route stenosis could be identified.

Under general anesthesia, an Excluder endograft (W. L. Gore & Associates, Inc., Flagstaff, Ariz) was deployed via the femoral artery. After coil embolization of the left internal iliac artery, the left leg of the graft was deployed into the external iliac artery. Completion aortography showed a slight T2EL from the inferior mesenteric artery (IMA), and the procedure was completed without any other apparent complications.
Recovery from coagulopathy postoperatively was delayed, but the vital signs were stable. However, 2 hours later in the Cardiac Care Unit, the patient was again in shock. CECT showed marked enlargement of the retroperitoneal hematoma and persistent extravasation from the IMA to the site of the aneurysmal wall rupture (Fig. 1). This confirmed rebleeding from the T2EL.

TAE for hemostasis was performed under general anesthesia. A 4-Fr sheath was placed from the right femoral artery, the superior mesenteric artery was selected using a 4-Fr Shepherd hook catheter (Medikit Co, Tokyo, Japan) with well-stabilized, a 2.2-Fr SHIRABE catheter (Piolax Co., Yokohama, Japan) was advanced via Riolan’s arcade to the origin of the IMA, and the root of the IMA was coil embolized (Fig. 2). The time required to this point was 28 min, and the shock resolved rapidly after embolization.

During surgery, abdominal distention and board-like rigidity developed, and an abdominal compartment syndrome (ACS) was diagnosed. Therefore, hematoma evacuation was performed via a retroperitoneal approach. No active bleeding was observed because of post embolization of the IMA, and the hematoma was removed as much as possible with hemodynamically stable. A drain was then placed, and the incision was closed to complete surgery. Transfusion, including initial treatment, included 32 units of MAP and 10 units of FFP.

CECT at 1 month after the operation showed no obvious endoleak and marked volume reduction of the retroperitoneal hematoma (Fig. 3).

The patient’s postoperative course was satisfactory, and he transferred to another hospital.

**Discussion**

RAAAs have a very poor prognosis, with about an 85% mortality rate. A meta-analysis in 2002 showed that even with surgical treatment, the early mortality rate was 48%, and survival rates have not improved over the last 40 years with open surgery. Therefore, less-invasive EVAR has
recently been promising and is increasingly indicated for treatment of RAAAs.

Since Yusuf et al. first reported EVAR for RAAAs in 1994, EVAR has been performed in a large number of hospitals. A systematic review and meta-analysis in 2008 reported a 21% mortality rate with EVAR for RAAAs. Furthermore satisfactory clinical results of ‘EVAR-first protocol’ has been increasingly reported. Speicher et al. reported that EVAR should be strongly considered for all RAAA patients with acceptable anatomy. We also take EVAR-first protocol if the morphologic anatomy is suitable for EVAR.

On the other hand, the IMPROVE randomized trial of open repair vs. EVAR failed to show superiority of EVAR. Thus, the indications for EVAR must be carefully considered in each individual patient.

One of the important complications of EVAR is an endoleak. If a type I endoleak persists, open conversion should promptly be considered, whereas many type II and IV endoleaks resolve spontaneously, so specific treatment may be unnecessary.

However, when CECT shows frank rupture with extravasation, as in the present case, and coagulation is impaired, hemostasis becomes difficult and precautions are necessary. Therefore, careful consideration of EVAR indications, including selection of a device, and strict postoperative management are important. Recurrent shock due to T2EL after EVAR for RAAA has not been previously reported.

In cases of rupture with coagulopathy, intraoperative sac embolization using N-butyl-2-cyanoacrylate to prevent continued bleeding due to an endoleak has been reported. Although there are remaining issues, such as the complicated nature of the procedure, selection of an embolic material, and endpoints, this procedure is promising as a solution in these cases. When persistent bleeding is suspected, blood transfusions and supplemental clotting factors for functional hemostasis and prompt re-evaluation with CECT are essential. If a type II endoleak is confirmed as the cause, emergency TAE should be considered.

Another important factor affecting the prognosis in RAAAs is an ACS. ACS may be due to several factors, and an increase in intra-abdominal pressure can lead to multi-organ failure with a poor prognosis. ACS occurs in 18% of RAAA cases; significantly higher mortality rates in patients with ACS than without ACS have been reported; and a correlation exists with the need for large transfusion volumes, elevated activated partial thromboplastin time, and concomitant use of an aortic balloon. As a means of prevention, intra-bladder pressure can be monitored over time, and if there are signs of ACS (intra-bladder pressure ≥20 mmHg), prompt open abdominal management for tension reduction is important. However, retroperitoneal hematoma evacuation during EVAR or open repair has a potential risk of re-bleeding due to loss tamponade effect, the indication still remains controversial. Further reports are required to determine the indication of this procedure for all RAAA patients with hemodynamically unstable.

In all patients with an RAAA treated, the most important points are to achieve hemostasis as promptly as possible and to shorten the time until starting surgery and the operative time by following a protocol. When the risk of general anesthesia is high, a percutaneous approach under local anesthesia should be considered. Early treatment of shock and coagulopathy is essential, including aggressive concomitant use of an aortic balloon, transfusion of blood and clotting factors, monitoring for ACS, and open abdominal management when necessary. This comprehensive management strategy can contribute to improved survival rates.

**Conclusion**

The case of a patient in whom a life-saving emergency TAE was performed for recurring shock due to persistent bleeding from a T2EL after EVAR for an RAAA was described. In patients with frank rupture and coagulopathy, the possibility of this complication should be kept in mind. This requires careful consideration of the indications for EVAR and strict postoperative follow-up.

**Conflict of Interest Disclosure Statement**

Nishimaki H reports personal fees from COOK JAPAN INC, personal fees from Medtronic Japan Co., Ltd., personal fees from Japan Lifeline Co., Ltd, personal fees from Medico’s Hirata Inc., outside the submitted work. Ogawa Y and the other co-authors have no conflict of interest to declare.

**References**

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