Conversion to Open Repair from Emergency EVAR in a Patient with Ruptured AAA: Report of a Case

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A 77-year-old woman with a ruptured abdominal aortic aneurysm (AAA) was transferred to our hospital. Due to a severe comorbidity, endovascular aortic repair of the ruptured AAA was proposed. During the operation, although a Zenith® AAA endovascular graft was deployed, digital subtracted angiography revealed an enhancement of the endoleak, and the patient became hemodynamically unstable. Therefore, we decided to convert to graft replacement of the abdominal aorta through a median laparotomy. During the postoperative period, the patient suffered from ischemic colitis, which resolved with conservative therapy. She was discharged after 33 postoperative days.

Keywords: ruptured abdominal aortic aneurysm, endovascular aortic repair, conversion to open repair

INTRODUCTION

Ruptured abdominal aortic aneurysm (AAA) is a fatal disease, and the in-hospital mortality of conventional open repair for rupture AAA still remains high. Recently, many papers have reported that surgical outcomes for ruptured AAA were improved by emergency endovascular aortic repair (EVAR).1–4 We have also performed emergency EVAR in limited patients with ruptured AAA since 2011. Regardless of the appropriate patient selection, there are patients in whom intraoperative conversion from emergency EVAR to open repair must be performed. We present a successful case of conversion to open repair from emergency EVAR in a patient with ruptured AAA.

CASE REPORT

A 77-year-old woman was admitted to a local hospital for clinical examination of AAA, but severe diarrhea caused by infectious enteritis developed soon after her admission. She was placed on bowel rest, and intravenous fluid therapy was initiated. During hospitalization, her chronic kidney disease deteriorated, and hemodialysis was transiently required. For this reason, clinical examination for AAA was not performed, and she became bedridden. Three weeks later, she developed severe abdominal pain and shock. Emergency computed tomography revealed a 65-mm maximal diameter infrarenal AAA rupture, with a huge retroperitoneal hematoma (Fig. 1). At this point, she was transferred to our hospital. On admission, she was fully conscious and hemodynamically stable, but her hemoglobin had decreased from 8.9 to 5.1 g/d. Given the patient’s comorbidity, we felt that a conventional open repair would not be tolerated, so we prepared for EVAR as well as open repair.

During the operation, the patient was placed in the supine position under general anesthesia with endotracheal intubation. First of all, angiography was performed via
the right femoral artery. Digital subtracted angiography (DSA) demonstrated a ruptured AAA located in the terminal aorta, which fulfilled the guidelines for an elective EVAR; therefore, we decided to perform an EVAR. After DSA was performed again in order to show that the delivery sheath was inserted into the appropriate position via right femoral artery (Fig. 2A), a Zenith® AAA endovascular graft was deployed just below the renal arteries to both common iliac arteries. However, the DSA showed enhancement of the endoleak (Fig. 2B). We tried to type the endoleaks but could not. The patient gradually became hemodynamically unstable, despite the large amount of blood transfused; hence, we decided to convert to open repair. A median
laparotomy was performed, and the infrarenal aorta in which the main body of the endograft was implanted was clamped gently. When the aneurysm sac was opened, we found massive bleeding from the orifice of the 4th lumbar arteries and inferior mesenteric artery (IMA) into the aneurysm sac. After the orifice of the 4th lumbar arteries and IMA were ligated to stop the bleeding, almost all of the endograft was removed, leaving a piece that could not be taken by the infrarenal aortic cross-clamp. After the stent was partially resected by the wire cutter, the tube graft was anastomosed to the infrarenal aorta with the endograft. The graft replacement was then completed by anastomosing the opposite side of the tube graft with the aorta. Operative time was 369 minutes: 194 minutes for the EVAR procedure and 175 minutes for the graft replacement. Postoperative 3D-CT showed a piece of endograft left at the proximal anastomosis site of replaced tube graft (Fig. 3).

During the postoperative period, the patient suffered from ischemic colitis, which resolved with conservative therapy. Clinical improvement was observed over time, and she was discharged after 33 postoperative days.

**Discussion**

As a less invasive treatment for elective surgery for AAA, EVAR has rapidly spread throughout Japan, since it became commercially available in 2006. However, emergency EVAR in patients with ruptured AAA still remains a contraindication, with well experienced operators currently performing emergency EVAR at their own risk in limited hospitals. Unlike in Japan, Yusuf et al. have reported their first successful cases of emergency EVAR for patients with ruptured AAA in the United States. Since publication, there has been a yearly rise in the proportion of ruptured AAA treated by EVAR in the United States, reaching 18.9% in 2006. Much literature has demonstrated EVAR lowering overall in-hospital mortality compared with open repair in patients with ruptured AAA. The mortality of EVAR and open repair for ruptured AAA during the same period was 24.5% and 44.4% respectively. We consider that these data do not necessarily prove the superiority of EVAR in the treatment of ruptured AAA because there are patients with ruptured AAA who have anatomically unsuitable aneurysms for EVAR, and selection bias must exist in these data. However, results showing that the overall ruptured AAA mortality was much lower in a surgical unit – which offered the patients both open repair and EVAR – than that which is generally accepted suggest that emergency EVAR can be an effective option in the treatment of ruptured AAA, when operators select patients that will benefit from EVAR over open surgery. In our case, we chose to treat the ruptured AAA by emergency EVAR because there were experienced operators for EVAR in our hospital and because the EVAR components were immediately available at that time. Furthermore, the patient had severe comorbidities and also had an aneurysm that was anatomically suitable for EVAR. However, the most encouraging reason why we decided to perform EVAR was that the patient was hemodynamically stable. If the patient was hemodynamically unstable on admission, we would not have been able to prepare the EVAR treatment.

Despite appropriate patient selection and the improvement in endovascular techniques, there are times when intraoperative conversion to open laparotomy is required. Karkos et al. found that intraoperative open repair was necessary in 44 of 784 patients (6%) who underwent emergency EVAR for ruptured AAA. Among 24 patients with available information, the cause of open conversion was: access difficulties in 5, type I endoleak and/or stent-graft migration in 4, continued blood loss in 4, inadvertent renal artery overstenting in 1, stent-graft thrombosis in 1, inability to catheterize the contralateral limb in 1, unspecified endoleak in 1, technical error in 1,
and unknown information in 6.6) Except for inadvertent renal artery overstretching and stent-graft thrombosis, all other causes of conversion to open repair were associated with uncontrollable bleeding. For ruptured AAA, any type of endoleaks can cause blood loss inducing patients’ hemodynamic instability. Although additional endovascular repair is one option to resolve endoleaks, implantation of an additional aortic cuff or balloon expandable bare metal stent at the proximal landing zone for resolution of type I endoleaks can disturb the infrarenal aortic clamp following the open repair. Coil embolization for resolution of type II endoleak may also take a lot of time. In our case, we decided to convert open repair when the patient became hemodynamically unstable. We found that the massive bleeding from the orifice of the 4th lumbar artery and IMA, suggesting that a type II endoleak contributed to her hemodynamic instability. If we had not given up continuing to perform the endovascular repair, we might have missed the timing of conversion to open repair, and the patient could have been in danger of falling into an irreversible state. The overall mortality in patients with ruptured AAA who convert to open repair intraoperatively was high in 78%6) and this unsatisfactory result may be affected by a delayed decision, in the conversion to open repair.

Surgical techniques of conversion to open repair following EVAR differs depending on the design of the endograft.11) In our case, a Zenith® endograft containing suprarenal bare metal stent as a fixation system was implanted. Therefore, total removal of endograft necessitates a suprarenal or suprarecifial cross-clamp. However, suprarenal or supraceliac cross-clamping has a risk of visceral organ ischemia, depending on cross-clamp time. Therefore, we performed cross-clamp at the infrarenal abdominal aorta in which the main body of the endograft was implanted. We were also careful not to clamp the aorta where the suprarenal bare metal stent was implanted, to escape the risk of dissection. Although a piece of endograft was left in the proximal suture line, after we resected the stent attached outside the endograft by wire cutter, we could easily anastomose the graft to the aortic wall with the endograft.

**Conclusion**

In conclusion, although EVAR is an effective option for treatment of ruptured AAA, in cases where patients become hemodynamically unstable, we should not hesitate to convert to open repair.

**Disclosure Statement**

Toshiro Ito and other co-authors have no conflict of interest.

**References**