**A Patient in Whom Antegrade Blood Flow Blockage with a Balloon Guiding Catheter Was Effective for External Iliac Artery Rupture on Sheath Insertion**

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**Objective:** We report a patient in whom antegrade blood flow blockage with a balloon guiding catheter was effective for external iliac artery (EIA) rupture on 9 Fr sheath insertion.

**Case Presentation:** Thrombectomy was selected for a 76-year-old male in the acute phase of cerebral infarction. The right common femoral artery (CFA) was punctured, and a 4 Fr sheath was exchanged for a 9 Fr sheath. At this point, EIA rupture occurred, causing shock. Hemostasis was not achieved by manual compression. The contralateral CFA was punctured, and a 9 Fr OPTIMO (Tokai Medical Products, Aichi, Japan) was guided to proximal side of the point of rupture. His blood pressure was stabilized by blocking antegrade blood flow via balloon inflation. Artificial blood vessel replacement was performed, leading to a favorable outcome.

**Conclusion:** Antegrade blood flow blockage with a balloon was effective for EIA rupture.

**Keywords**
- external iliac artery rupture
- retroperitoneal hematoma
- puncture-associated complications
- a balloon guiding catheter

**Introduction**

Recently, endovascular treatment has been increasingly performed in the cerebrovascular field. Although there have been marked advances in devices for endovascular treatment, some treatment procedures require the insertion of a large-diameter sheath. It is often difficult to secure an access route involving the site of puncture due to the increase in the number of elderly patients.

When performing endovascular treatment, puncture-associated complications may occur. As such complications, hemorrhage at the site of puncture, pseudoaneurysms, arteriovenous fistulae, vascular rupture, and thrombotic occlusion have been reported.\(^1\)\(^-\)\(^5\) Hemorrhage at the site of puncture or vascular rupture may lead to retroperitoneal hematoma formation, decreasing the blood pressure, so caution is needed in particular.

In this study, we report a patient in whom external iliac artery (EIA) rupture occurred on exchange of a 4 Fr sheath for a 9 Fr sheath after puncture of the right common femoral artery (CFA) during emergency thrombectomy for acute cerebral infarction, causing shock. However, his blood pressure was stabilized by promptly puncturing the contralateral CFA, guiding a 9 Fr OPTIMO (Tokai Medical Products, Aichi, Japan) to an area proximal to the site of rupture, and blocking antegrade blood flow via balloon inflation. Artificial blood vessel replacement was then performed, leading to a favorable outcome.

**Case Presentation**

Patient: A 76-year-old male.

Medical history: Hypertension, atrial fibrillation, and cerebral infarction.
The patient was taken to a previous hospital by ambulance with dysarthria and left hemiparesis. Head CT revealed no hemorrhagic lesion, and the patient had a diagnosis of acute cerebral infarction, and was referred to our hospital.

On arrival, his Glasgow Coma Scale score was E4V4M6, and dysarthria and left hemiparesis were observed. The National Institute of Health Stroke Scale score was 12 points. Cerebral MRI demonstrated a high-signal-intensity area involving the right insular cortex to the parietal lobe on diffusion-weighted images (DWIs) (Fig. 1A and 1B). The DWI-Alberta Stroke Programme Early CT Score was 8/11 points. MRA revealed occlusion of the branch of the right middle cerebral artery (MCA) (Fig. 1C). Although the interval from onset until this point was 3 hours, he had a platelet count of 90,000/µL on blood testing. As intravenous injection therapy with alteplase was contraindicated, direct thrombectomy was selected.

The right CFA was punctured, and a 4 Fr long sheath was inserted. Initially, right internal carotid angiography was performed using a 4 Fr catheter to confirm occlusion of the branch of the right MCA. Subsequently, we removed the 4 Fr sheath, and attempted to exchange it for a 9 Fr sheath along the guidewire; however, vascular torsion was marked, making it difficult to insert the 9 Fr sheath.

The sheath seemed to jump when slowly pushed. The patient then complained of pain in the right lower limb, and became restless. There was a decrease in blood pressure (systolic blood pressure: approximately, 100 mmHg). As vascular injury was suspected, angiography was conducted via the 9 Fr sheath. Right EIA rupture-related extravasation was noted (Fig. 2A). It was difficult to achieve hemostasis by manual compression, and rapid massive fluid transfusion was performed, but it was impossible to maintain blood pressure. Systolic blood pressure decreased to approximately 50 mmHg, causing shock. Initially, a 9 Fr OPTIMO was inserted through the 9 Fr sheath, which had been inserted through the right CFA. We tried to pass the OPTIMO through the site of rupture to a proximal area. However, vascular torsion was marked, making this difficult. For this reason, the left CFA was punctured, and a 9 Fr sheath was inserted. The 9 Fr OPTIMO was guided from the left side to the proximal side of the point of right EIA rupture. Balloon inflation was conducted to block antegrade blood flow (Fig. 2B). The patient’s systolic blood pressure increased from 120 to 130 mmHg and stabilized. Angiography indicated slight retrograde extravasation, but contrast medium pooling was noted (Fig. 2C). As hemorrhage control was favorable, we waited for operating-room
Effectiveness of a Balloon Guiding Catheter for EIA Rupture

Based on adequate preoperative assessment. The number of elderly patients has increased, and physicians may often encounter patients with marked vascular torsion. Therefore, it is important to assess and confirm an access route before surgery.

In the present case, emergency thrombectomy was performed, and detailed preoperative assessment was unable to be conducted. A 4 Fr sheath was inserted without problems. However, when inserting a 9 Fr sheath, it was caught at the site of vascular torsion and the surgeon pushed it by force, leading to vascular rupture. In general, 9 Fr sheaths should be inserted to proximal site of vascular torsion, and then inserted to the depths after the blood vessel is linearized by inserting a coaxial system consisting of a 9 Fr OPTIMO and inner catheter in advance using a guidewire.

In most cases of hemorrhage at the site of femoral puncture, hematomas involve the femoral region, and shock rarely occurs. However, hemorrhage on the proximal side may lead to retroperitoneal hematoma formation, causing shock. The mortality rate is reportedly 6.6%. In such cases, when hemostasis is not achieved by manual compression, contralateral puncture and hemostasis with a balloon at the point of hemorrhage are effective.

Iliac artery rupture, as observed in the present case, is rare, but it may lead to retroperitoneal hematoma formation, causing shock. As many patients with unfavorable outcomes have been reported, accurate, prompt diagnosis and management are required. Surgical repair for iliac artery rupture has been routinely performed, and for patients who cannot wait until surgical repair, covered stents for the bile duct may be employed. Indeed, covered stent or stent-graft insertion has been increasingly reported.

In Japan, a stent-graft for peripheral blood vessels was approved. However, in many hospitals, devices

**Discussion**

The increase in the number of patients for whom cerebral endovascular treatment is indicated has emphasized the importance of complication management. Most physicians consider intraoperative thromboembolism or cerebral aneurysmal rupture during cerebral aneurysm treatment, but puncture-associated complications may occur regardless of the type of endovascular treatment.

For cerebral endovascular treatment, femoral puncture is frequently performed, and the incidence of puncture-associated complications is reportedly 0%–17%. Some treatment procedures require the insertion of a large-diameter sheath. In such cases, caution is needed to prevent puncture-associated complications in particular. As such complications, hemorrhage at the site of puncture, pseudoaneurysms, arteriovenous fistulae, vascular rupture, and vascular occlusion have been reported.

To prevent these complications, it is necessary to have accurate knowledge and carefully perform procedures based on adequate preoperative assessment. The number of elderly patients has increased, and physicians may often encounter patients with marked vascular torsion. Therefore, it is important to assess and confirm an access route before surgery.

In the present case, emergency thrombectomy was performed, and detailed preoperative assessment was unable to be conducted. A 4 Fr sheath was inserted without problems. However, when inserting a 9 Fr sheath, it was caught at the site of vascular torsion and the surgeon pushed it by force, leading to vascular rupture. In general, 9 Fr sheaths should be inserted to proximal site of vascular torsion, and then inserted to the depths after the blood vessel is linearized by inserting a coaxial system consisting of a 9 Fr OPTIMO and inner catheter in advance using a guidewire.

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In Japan, a stent-graft for peripheral blood vessels was approved. However, in many hospitals, devices
cannot be prepared in an emergency situation. Furthermore, it is difficult to maintain the true lumen of a markedly tortuous blood vessel using a guidewire, as demonstrated in the present case, and end leakage may occur due to kinking of the vessel.

In the present case, a rapid decrease in blood pressure led to shock, and there was no time to prepare new devices such as balloons. Furthermore, prompt use of a covered stent or stent-graft was impossible. Therefore, we attempted to guide an OPTIMO, which had been prepared for thrombectomy, to the proximal side of the point of rupture through the right CFA. However, vascular torsion was marked, inducing stress at the site of rupture, thus making this attempt difficult. For this reason, the left CFA was punctured, and an OPTIMO was guided to the right side. As OPTIMO balloon inflation at the point of rupture was considered to enlarge the point of rupture, it was conducted at the proximal side of the point of rupture to block antegrade blood flow. Blood pressure was successfully stabilized, but retrograde blood flow remained. If circulatory dynamics are not stabilized by proximal blockage alone, direct blockage with a balloon at the point of rupture may be necessary. In such cases, new vascular injury related to large-diameter sheaths or catheters may occur. If there is enough time/manpower, small-diameter systems should be used. As percutaneous transluminal angioplasty (PTA) balloons for peripheral blood vessels, those measuring 6–7 mm in diameter are available with a 6 Fr sheath. However, to achieve complete hemostasis, balloons measuring 9–10 mm in diameter should be selected, and a 7 Fr sheath must be inserted. If hemostasis is difficult despite this procedure, aortic blood flow should be blocked by inserting an intra-aortic balloon occlusion (IABO) catheter. If there is no other method, the use of a covered stent for the bile duct may be a treatment option.

When performing endovascular treatment, devices to adequately manage complications at any time from puncture until hemostasis must be prepared.

**Conclusion**

We treated a patient in whom EIA rupture occurred on insertion of a 9 Fr sheath during thrombectomy, causing shock. However, antegrade blood flow blockage with an OPTIMO balloon led to a favorable outcome. Antegrade blood flow blockage with a balloon was effective for EIA rupture.

**Disclosure Statement**

There is no conflict of interest regarding this article.

**References**