—Case Reports—

Elective Endovascular Stent-Graft Implantation for External Iliac Artery Injury after Blunt Pelvic Trauma

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External iliac artery (EIA) injuries caused by blunt trauma are rare. Here, we describe a blunt EIA injury after a motorbike accident suffered by a 16-year-old male. Despite conservative treatment, intermittent claudication persisted. He was successfully treated by elective endovascular stent-graft implantation on day 59 after the injury. Ankle-brachial index (ABI) improved, as did his symptoms. A contrast-enhanced computed tomography scan on postoperative day 90 showed no residual stenosis and favorable peripheral blood flow. This report suggests that elective endovascular stent-graft implantation might be a viable treatment option for blunt EIA injuries. (J Nippon Med Sch 2022; 89: 342–346)

Key words: ankle-brachial index, blunt trauma, endovascular stent-graft implantation, external iliac artery

Introduction

External iliac artery (EIA) injuries caused by blunt trauma are rare[1,2]. Potential treatment options for such injuries include surgical intervention (open surgery), endovascular treatment, and conservative treatment[3,4]. In patients with EIA, high-grade pelvic fracture and severe leg injuries are risk factors for limb amputation[4]. Immediate revascularization is particularly important in patients with "hard signs" of vascular injury and lower-extremity fractures and dislocations[2]. These signs include 1) active or pulsatile hemorrhage, 2) pulsatile or expanding hematoma, 3) clinical signs of limb ischemia, 4) diminished or absent pulses, and 5) bruit or thrill, suggesting arteriovenous fistula.

Surgical treatment is preferred for blunt iliac artery injury[3]. Although a few previous case studies reported successful endovascular stenting for acute iliac artery injury[5,6], evidence is limited for endovascular treatment for subacute to chronic EIA injuries.

Here, we present a case of traumatic EIA occlusion successfully treated with stent-graft implantation after failure of conservative management.

Case Report

A previously healthy 16-year-old male (height: 173 cm; weight: 66 kg) slipped while riding his 50-cc motorbike and hit his lower abdomen against a guardrail. When the emergency medical personnel arrived at the scene, he complained of lower abdominal pain, numbness in the left leg, and pain in the left side of his back. He was transported to the emergency department of a nearby tertiary care hospital by ambulance.

On arrival at the hospital, physical examination revealed a blood pressure of 134/73 mm Hg, pulse rate of

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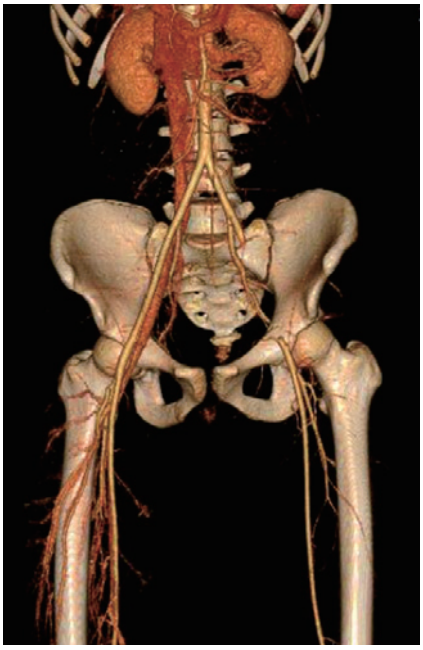

Fig. 1 A 3-dimensional, contrast-enhanced computed tomography scan reveals a 120-mm-long vascular occlusion extending from the left external iliac artery to the left common femoral artery.

73 bpm, respiratory rate of 16 cycles/min, and a bruise approximately 4 cm to the left of the pubic symphysis. His left leg was painful and cold to the touch, and the left dorsalis pedis artery had a weak pulse. A computed tomography (CT) scan of the abdomen and pelvis revealed a left acetabular fracture. A 3-dimensional, contrast-enhanced CT scan revealed a 120-mm-long vascular occlusion extending from the left EIA to the left common femoral artery (**Fig. 1**). Axial images showed a proximally thrombosed lumen (arrowhead) and severe contusion at the site of the lesion (arrow) (**Fig. 2**). Blood flow to the peripheral artery was maintained through collateral circulation. After the initial assessment, the patient was referred to our hospital for a comprehensive treatment plan, including acute surgical and endovascular treatment.

While being transported to our hospital, the patient complained of pain and tenderness in the left inguinal region and numbness of the left foot. His vital signs were stable, with no external bleeding or subcutaneous hematoma. The plantar temperature was 36.6°C on the right side and 32.8°C on the left. Percutaneous Doppler ultrasonography showed reduced patency of the left dorsalis pedis artery. The patient was admitted to the intensive care unit for 5 days after the injury and transferred to the general ward on day 6. On day 7 after the injury, the ankle-brachial index (ABI) on the left side was 0.45. In accordance with the patient's wishes, we provided conservative treatment comprising exercise therapy and cilostazol (200 mg per day), despite the hard signs of distal ischemia.

Some symptoms, including intermittent claudication in the left lower thigh, did not resolve with conservative treatment. Contrast-enhanced CT scans showed findings similar to those observed immediately after the patient's arrival at hospital. The left ABI on days 21, 48, and 57 after the injury was 0.48, 0.53, and 0.54, respectively (**Fig. 3**). Because of the absence of substantial improvement after conservative therapy, elective endovascular stent-graft implantation was planned.

On day 59 after the injury, elective endovascular stent-graft implantation was performed using the contralateral retrograde transfemoral approach. A pelvic angiogram showed a 120-mm complete occlusion of the left EIA (**Fig. 4A**). The occluded proximal EIA was easily probed using a standard Halberd micro-guidewire. As the distal cap was very hard, we used a high-penetration hydrophilic guidewire (Astato 30, ASAHI INTECC, Aichi, Japan) to traverse the lesion. Thereafter, after preballooning, two heparin-bonded stent grafts (GORE VIABAHN Endoprosthesis; 8 mm × 100 mm and 8 mm × 50 mm; Gore Medicals, Flagstaff, AZ, USA) were placed in an overlapping manner (**Fig. 4B**). The lesion was hard (**Fig. 4C**), and a special Conquest balloon (8 mm × 40 mm, 27 atm) was required for full expansion. The completion angiogram revealed no residual stenosis (**Fig. 4D**). A 3-dimensional, contrast-enhanced CT scan on postoperative day 90 showed no residual stenosis and favorable peripheral flow (**Fig. 5**).

On postoperative day 1, all persistent symptoms improved, and the left ABI was 0.98. On postoperative day 4, the patient was asymptomatic and was discharged. The left ABI was 1.01 at 96 days after the surgery. In addition to cilostazol, 100 mg of aspirin was prescribed for 6 months.

Discussion

In this case of blunt traumatic EIA injury, we used the ABI as an indicator of peripheral circulation, and elective endovascular stent-graft implantation was performed after failure of conservative management. Elective endovascular stent-graft implantation can be a treatment option even in the subacute phase of EIA injury after blunt trauma.

Until recently, open surgical revascularization was the only treatment for acute EIA injury after blunt trauma[4].

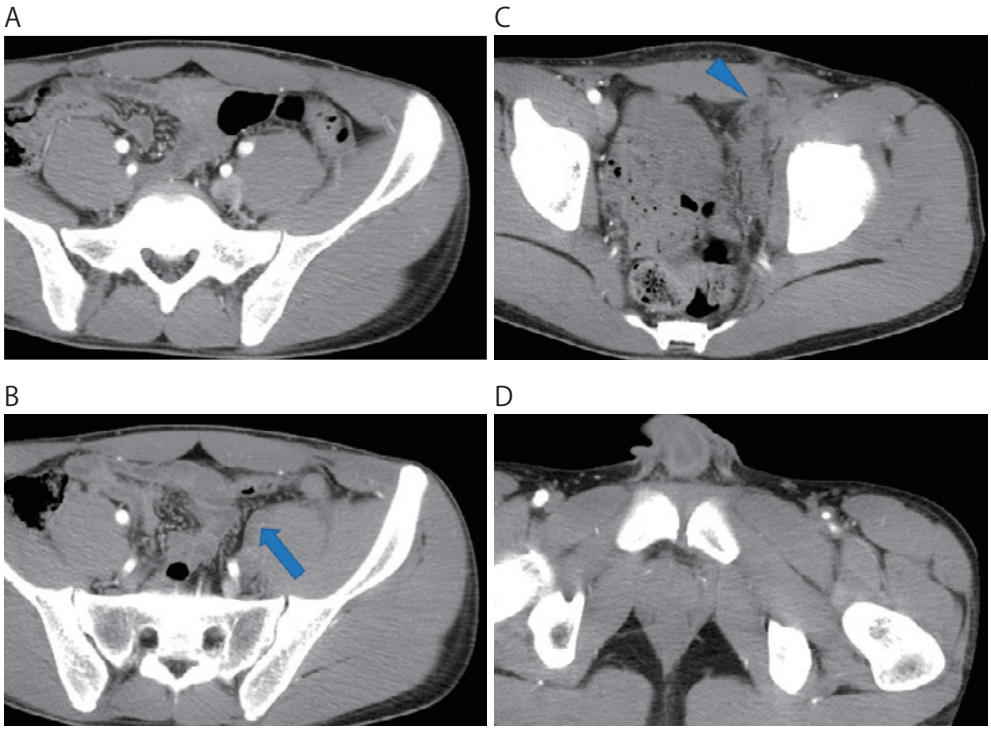

Fig. 2 Sequential axial images of pelvic contrast-enhanced CT show a persistent left external iliac artery (A), thrombosed lumen (B), severe contusion at the site of the lesion (C), and patent left common femoral artery with perivascular edema (D).

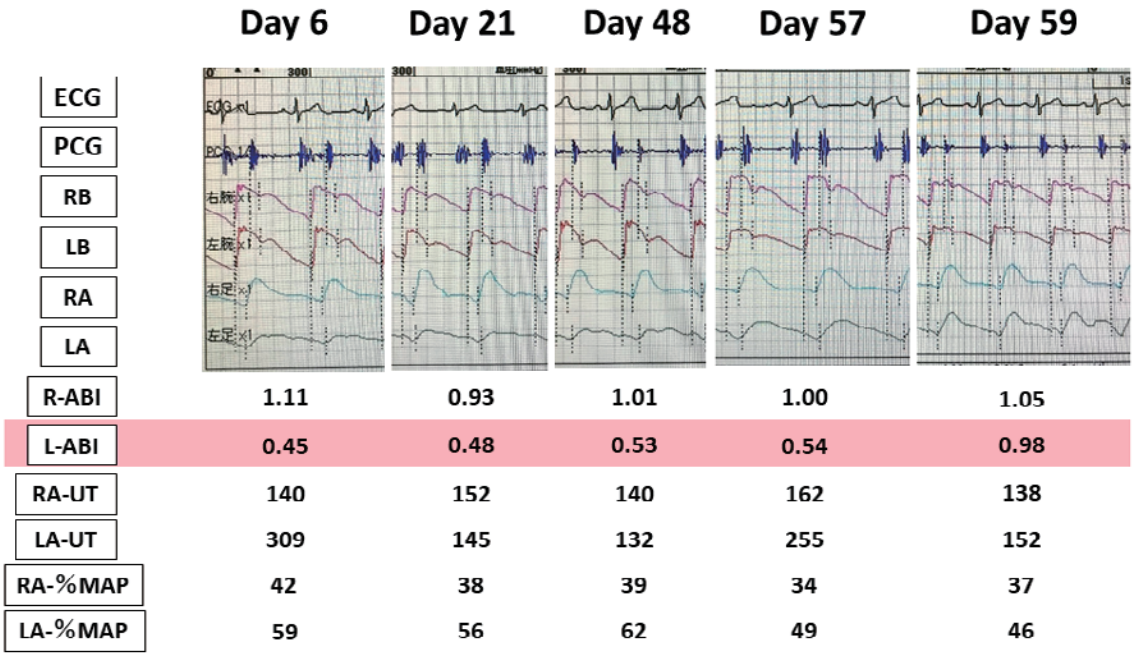

Fig. 3 Sequential changes in clinical variables after blunt trauma injury to the external iliac artery (the left ankle-brachial index is highlighted).
ECG - echocardiography; PCG-phonocardiogram; RB and LB - right and left brachial pressure respectively; RA and LA - right and left ankle pressure respectively; R-ABI and L-ABI - right and left ankle-brachial index respectively; UT - upstroke time; %MAP - percentage mean artery pressure

Less invasive treatment options, such as endovascular stent-graft implantation, have been recently adopted for treatment of other injuries[7]. Although a few studies have investigated the effectiveness of stent-graft implantation

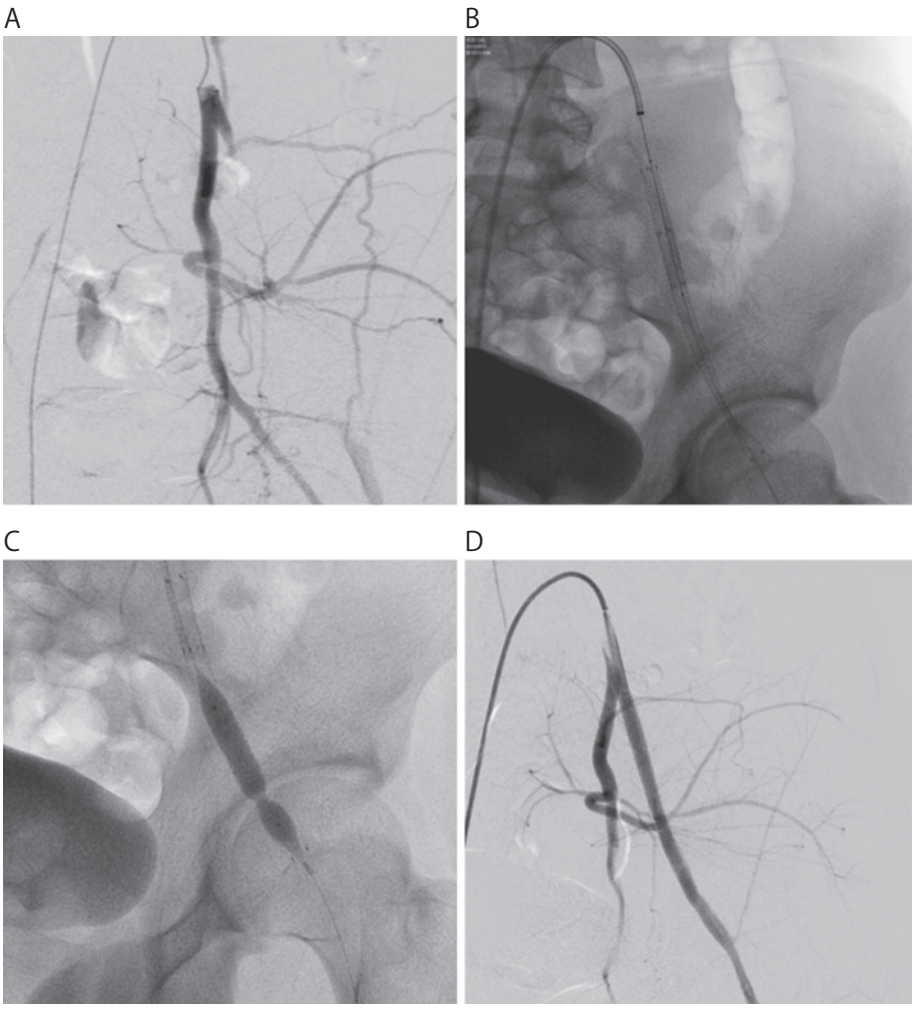

Fig. 4 Endovascular stent grafting for external iliac artery injury.
A: Pelvic DSA demonstrates total occlusion (length 120 mm) in the left external iliac artery.
B: Two GORE VIABAHN Endoprostheses 8 mm × 100 mm, 8 mm × 50 mm (Gore Medicals; Flagstaff, AZ, USA) are placed in an overlapping manner.
C: Standard balloon shows a hard lesion of the external iliac artery.
D: Final DSA reveals no residual stenosis and disappearance of the collateral arteries.

for acute EIA injuries[5,6], to our knowledge, no study has reported its feasibility in the subacute phase. The present findings suggest that elective endovascular stent-graft implantation can be performed during the subacute phase of EIA occlusion after blunt trauma.

ABI is useful for evaluating the effectiveness of treatment for subacute to chronic EIA injury after blunt trauma. An ABI <0.90 indicates narrowing of the main artery[8], and a change in ABI of more than 0.15 is considered clinically significant[9]. In this case, although there was no significant change in the ABI after conservative treatment, it increased from 0.54 to 0.98 after endovascular stent-graft implantation, which corresponded to an improvement in clinical symptoms.

Several issues should be considered before our findings can be generalized. Recently, Yoshimura et al.[10] reported a similar case of blunt traumatic injury caused by a bicycle handlebar. The main differences between their case[10] and ours include the primary site of injury, worsening of CT findings during conservative treatment, and the revascularization method (open surgery vs. endovascular stenting). As mentioned in their report[10], endovascular treatment was not performed because the primary site of injury was the common femoral artery, while it was the external iliac artery in our case. The main element of EIA occlusion in our patient was likely intimal injury at the end of EIA; thromboembolism in the proximal EIA was secondary to the distal intimal injury. Various alternative therapeutic options could be considered in the early phase. The fresh thrombus might be removed

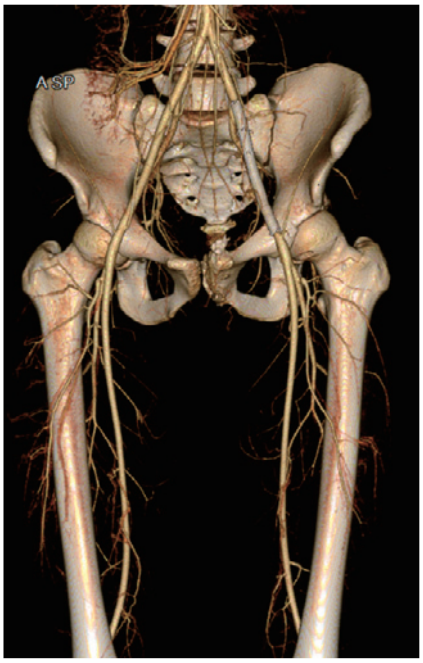

Fig. 5 A 3-dimensional, contrast-enhanced CT scan on postoperative day 90 shows no residual stenosis and favorable peripheral blood flow.

by surgical and/or endovascular thrombectomy, and localized dissection or laceration at the end of EIA might be surgically repaired. In contrast, options in the delayed phase are limited. Open surgery needs an ilio-femoral or femoral-femoral bypass. Among endovascular devices, only the stent-graft can achieve adequate revascularization via the percutaneous approach.

A concern for both endovascular stent-graft implantation and open revascularization using prosthetic grafts is that their long-term effects in young and adolescent patients are unknown. Future studies should thus investigate these effects.

In conclusion, elective endovascular stent-graft implantation was performed for subacute blunt EIA injury after failure of conservative management. Elective stenting may be a viable treatment option for subacute EIA injury after blunt trauma; however, long-term follow-up and additional clinical evidence are required in order to confirm the benefits of this treatment modality.

Conflict of Interest: None declared.

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