

Case Report

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Successful endovascular therapy in an elderly patient with severe hemorrhage caused by traumatic injury

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Abstract: An 85-year-old female suffered pelvic fracture, multiple rib fractures, right hemopneumothorax, and blunt abdominal aortic injury in a traffic accident. After transfer to our hospital, transcatheter arterial embolization (TAE) was performed immediately for hemorrhage from the bilateral internal iliac arteries. Enhanced computed tomography (CT) after TAE showed an increase of hematoma and extravasation at the bifurcation of the abdominal aorta. Therefore, emergency abdominal endovascular aortic repair was performed on the same day. On the 3rd day after transfer, metabolic acidosis worsened suddenly, and enhanced CT revealed intestinal necrosis. Emergency surgery for the intestinal necrosis was performed. The patient was transferred to the previous hospital on the 31st day after transfer. Endovascular treatment is useful for elderly patients with severe trauma. However, the preservation and/or reconstruction of the blood flow to important organs should be monitored.

Keywords: Abdominal injuries; Elderly; Stents; Trauma

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1 Introduction

Pelvic and aortic trauma can be critical, and urgent attention is required when hemorrhagic shock is complicated by those traumas. Endovascular treatment is a hemostasis procedure that can be performed using minimally invasive techniques. Here, we report a survival case who received endovascular treatment for pelvic fracture and traumatic aortic injury.

2 Case report

An 85-year-old female with no significant past or family history was struck by a vehicle, and then crushed under the same vehicle. She was immediately transferred to the previous hospital. Her physiological findings on arrival at the previous hospital were as follows: GCS, E3V4M6; blood pressure, 65/40 mmHg; heart rate, 110 beats/min; respiratory rate, 22 breaths/min; and SpO₂, 100% (face mask with reservoir, O₂ at 15 L/min). Imaging findings showed pelvic fracture, multiple rib fracture, right hemopneumothorax, and a suspicion of abdominal aortic injury. She was transferred to our hospital by helicopter emergency medical service after endotracheal intubation and right thoracic drainage.

She arrived at our hospital at approximately 3 hours after injury (at 18:24). Her physiological findings on arrival at our hospital were as follows: height, 146 cm; body weight, 35.5 kg; GCS, E1VTM1 (sedated, 'T' is an abbreviation of the endotracheal intubation, and 'VT' means 'V1'); blood pressure, 66/39 mmHg; heart rate, 81 beats/min; SpO₂, 100% (intubated and ventilated); and body temperature, 33.0°C (tympanic membrane temperature). Fracture of the sacrum and left pubis, partial disruption of the bilateral sacroiliac joints, and extravasation from left ilio-lumbar artery were observed in the enhanced computed tomography (CT) performed at the

previous hospital (Fig. 1a). In addition, left retroperitoneal hematoma, right (II-VII) and left (II-V) rib fractures were also observed. We concluded that the cause of shock was vascular injury due to pelvic fracture, and elected to perform urgent transcatheter arterial embolization (TAE). A catheter for intra-aortic balloon occlusion (IABO) was inserted from the right femoral artery to control bleeding prior to TAE. Angiography using 0.035 inch Radifocus® Guidewire (Terumo, Tokyo, Japan) and 4.2Fr pigtail catheter (Hanaco medical CO., LTD., Saitama, Japan) showed extravasation from the left iliolumbar artery, a branch of the left internal iliac artery (IIA), which agreed with CT findings performed at the previous hospital (Fig. 1b). In addition, there was an irregularity of the vessel walls in central site of the right IIA and suspected extravasation from the superior and inferior gluteal arteries, which are branches of the right IIA (Fig. 1c). Therefore, TAE for the bilateral IIA was performed. The trunk of the left IIA was embolized with an absorbable gelatin sponge (AGS, Serescue®, Nippon Kayaku, Tokyo, Japan) and the branches of the left IIA were embolized with n-butyl-2-cyanoacrylate (Histoacryl®, B.Braun Aesculap, Tokyo, Japan) mixed with iodized oil (Lipiodol®, FujiPharma, Toyama, Japan) at a ratio of 1:3. AGS was also used for TAE of the right IIA. At

that time, a pooling of some contrast media were observed around the abdominal aorta, and an abdominal aortic injury was considered. Because further treatment for the abdominal aorta with TAE was impossible, we decided to be prepared for urgent endovascular aorta repair (EVAR). The urgent angiography was started at 18:45 and terminated at 19:15, and 5Fr cobra catheter (MEDIKIT Co., LTD., Tokyo, Japan) and 1.7Fr microcatheter (Terumo, Tokyo, Japan) were used for TAE.

A 1400 ml transfusion of red blood cells was administered to the patient at the end of TAE, and her hemodynamics were temporarily stable. However, enhanced CT performed at 1 hour after arrival at our hospital revealed increased hematoma and extravasation around the bifurcation of the abdominal aorta (Fig. 2a, b). Furthermore, her hemodynamics became unstable again. We decided to perform urgent EVAR for injury of the abdominal aorta. The injury site of the abdominal aorta reached 10-35 mm proximal to the bifurcation of the abdominal aorta. Two aortic cuffs (Gore Excluder, W. L. Gore & Associates, Inc., Arizona, U.S.A.) were placed in the abdominal aorta to repair the injured site. During the surgery, additional TAE was performed in the trunk of the right IIA with coils and in the branches of the left IIA with AGS. In addition, an

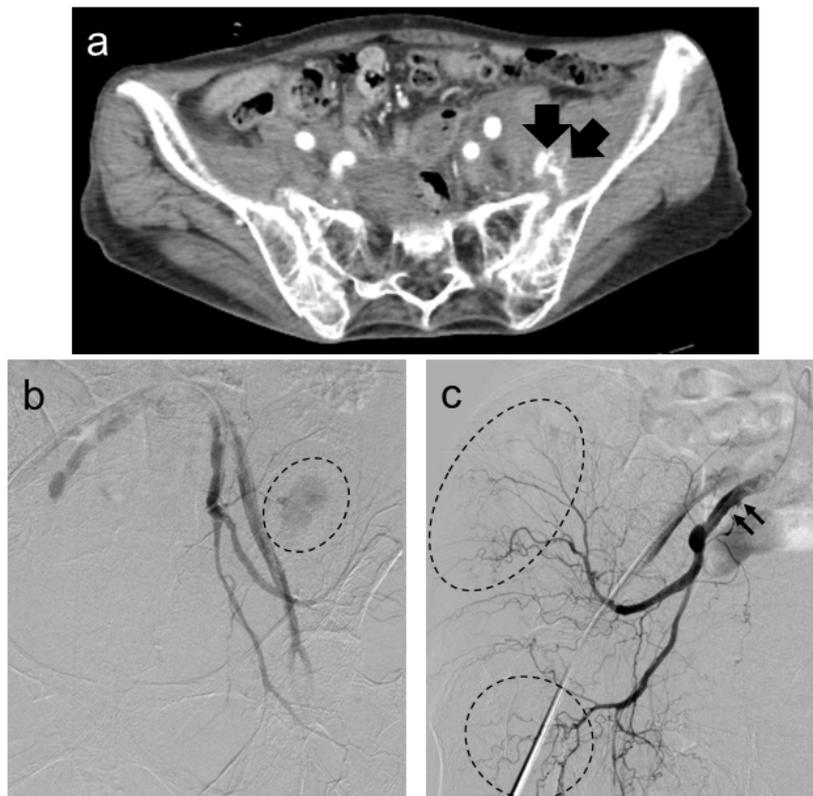


Figure 1: Enhanced CT shows extravasation from the left iliolumbar artery (a, arrows). Arteriography shows extravasation from the left iliolumbar artery (b, circle with dotted line), irregularity of the right internal iliac artery (c, arrows), and provides suspicion of extravasation from the superior and inferior gluteal arteries (c, circle with dotted line).

iliac extender (Gore Excluder, W. L. Gore & Associates, Inc., Arizona, U.S.A.) was placed in rt. external iliac artery to occlude rt. IIA because hemostasis insufficiency of rt. IIA was confirmed. The IABO catheter was removed. The time of operation and anesthesia was 161 min. and 195 min., respectively. A blood transfusion of 560 ml of red blood cells and 1470 ml of fresh frozen plasma was administered during surgery. Regarding the trauma severity, the Injury Severity Score (ISS) was 66, the Revised Trauma Score (RTS) was 6.376, and the predictive survival rate was 0.072.

The patient was transferred to ICU after the operation. We consulted orthopedics in our hospital regarding the pelvic fracture, and conservative treatment was selected based on their judgements. An additional blood transfusion included 3360 ml of red blood cells, 1140 ml of fresh frozen plasma, and 250 ml of platelet concentrates were administered on the 2nd hospital day. At that time, her hemodynamics were stable. However, metabolic acidosis suddenly worsened on the 3rd hospital day (pH 7.269; base excess, -9.7 mmol/L; lactic acid level, 8.1 mmol/L), and enhanced CT images revealed necrotic intestinal findings in the descending and sigmoid colons (Fig. 3). Emergency operation including partial ileectomy for necrotic distal

ileum, left hemicolectomy, and the construction of an ileostomy, colostomy, and enterostomy was performed. Her clinical course was uneventful after the second operation. The right chest drainage tube was removed on the 9th hospital day. The patient was moved from ICU to the general ward on the 30th day, and transferred to the previous hospital on the 31st day. At present, 24 months after injury, she lives at home.



Figure 3. Enhanced CT performed on the 3rd hospital day shows ischemia in the descending and sigmoid colon (a and b, white circle).

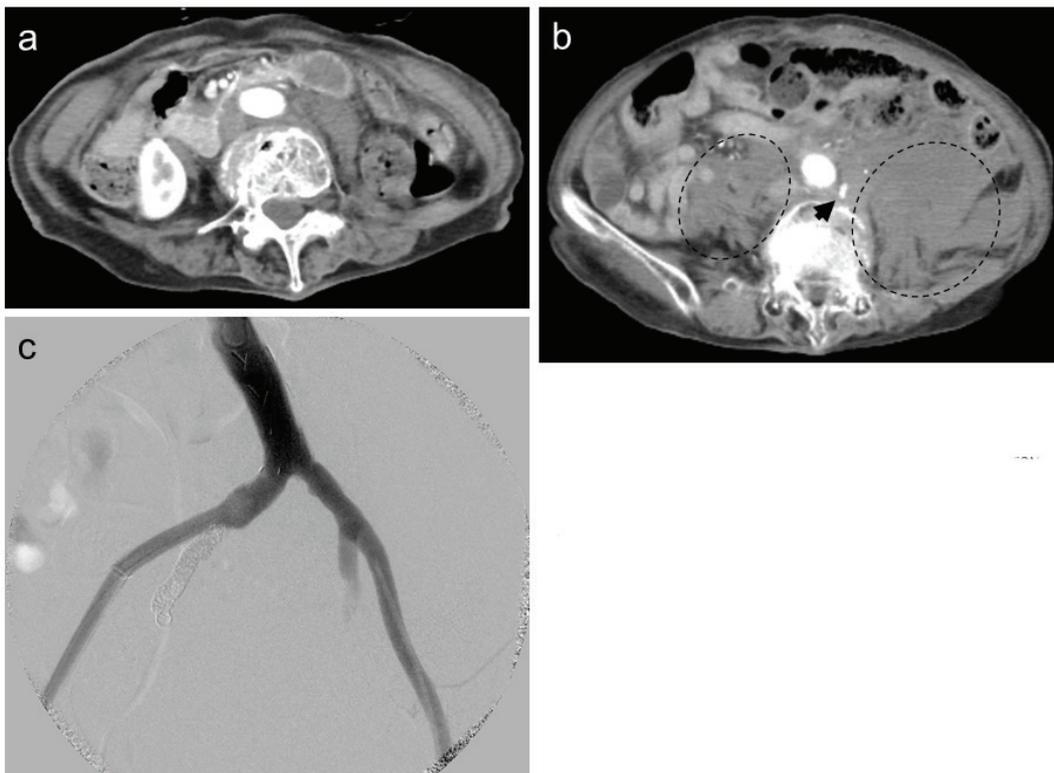


Figure 2. Enhanced CT performed after TAE shows increased retroperitoneal hematoma around the abdominal aorta (b, circle with dotted line) compared with that performed at the previous hospital (a). In addition, extravasation from the abdominal aorta (b, arrows) is observed. Endovascular aorta repair was performed (c).

Ht	19.0 %	TP	2.4 g/dl	Arterial bloodgas analysis	FiO ₂ 1.0
Hb	6.7 g/dl	Alb	1.0 g/dl	pH	7.192
RBC	2.25×10 ⁶ /μl	T-Bil	0.3 mg/dl	PCO ₂	41.1 mmHg
WBC	6800 /μl	AST	45 IU/l	PO ₂	218 mmHg
PLT	4.1×10 ⁴ /μl	ALT	22 IU/l	HCO ₃ -	15.1 mmol/L
Fib	31 mg/dl	CK	114 IU/l	BE	-11.6 mmol/L
PT	19 %	LDH	222 IU/l	SaO ₂	99.2 %
PT-INR	2.44	Amy	150 IU/l	Lactate	5.9 mmol/L
APTT	170 Sec.	BUN	28 mg/dl		
FDP	550.6 μg/ml	Cr	0.77 mg/dl		
DD	162.4 μg/ml	Na	137 mEq/l		
AT III	18.0 %	K	5.0 mEq/l		
		Cl	109 mEq/l		
		CRP	0.00 mg/dl		

Table 1: Laboratory data on arrival at our hospital

Ethical approval: The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

Informed consent has been obtained from this patient.

3 Discussion

Blunt injury of the abdominal aorta is rare at 0.04% of non-penetrating trauma [1] and 4-6% of blunt aortic injury [2, 3]. However, the mortality is high (18-37%) [1]. In addition, it has been reported that blunt injury of the abdominal aorta is a complication in 32% of pelvic fractures [2]. The injured lesion is generally influenced by the mechanism of injury. Shalhub *et al.* retrospectively analyzed 28 cases of blunt abdominal aortic injury [2]. They classified blunt abdominal aortic injury into three zones: Zone I, diaphragmatic hiatus to the superior mesenteric artery (SMA); Zone II, includes the SMA and renal arteries; and Zone III, from the inferior aspect of the renal arteries to the aortic bifurcation. Zone III is reported as the most common location of injury (20 cases, 71%). The injured lesion of our case is included in Zone III.

Conventional treatment for blunt abdominal aortic injury is surgical repair with laparotomy. However, the usefulness of EVAR has been reported recently. At present, an aortic blow-out rupture remains life-threatening and emergent laparotomy is required. However, partial injury of the aortic wall including dissection and pseudoaneurysm is a good indication for EVAR [1, 3, 4]. The conventional surgical repair of abdominal aorta with laparotomy might give the excessive invasiveness to this elderly patient with small body (height, 146 cm; body weight, 35.5 kg). We thought, that the less invasive treatment to both pelvic fracture and aortic injury by using endovascular therapy would lead to a good prognosis of this case.

Intestinal ischemia is a critical complication that should be considered when treatment for the abdominal aorta is provided. It has been reported that the preservation and/or reconstruction of the inferior mesenteric artery (IMA) or at least the unilateral IIA prevents intestinal ischemia during surgery of the abdominal aorta [5]. In the present case, we had no choice but to embolize the bilateral IIAs to obtain hemostasis. EVAR, which is a less invasive procedure compared with conventional aortic repair with laparotomy, was selected for aortic repair based on the age and general condition of the patient. However, the IMA was sacrificed by a stent graft as a result. We conducted strict management in the ICU and were able to cope with intestinal ischemia without missed time. We reflect that an additional procedure to preserve

intestinal blood flow, such as reconstruction of the IMA, was necessary.

It has been already reported that early rehabilitation interventions improves the outcomes of patients in ICU [6, 7]. This case was transferred to the previous hospital on the next day discharged from the ICU, however, she also received the rehabilitation for pulmonary and appendicular functions as soon as possible after the general condition became stable in our ICU. It might be possible that the early rehabilitation intervention had a positive influence on her postoperative outcome.

4 Conclusion

We experienced a patient who underwent successful emergent endovascular treatment for pelvic fracture and traumatic abdominal aortic injury. The endovascular treatment, which is less invasive, is useful for elderly patients with severe trauma. The preservation and/or reconstruction of blood flow to the important organs should always be considered.

Conflict of interest statement: The authors confirm that this article content has no conflict of interests.

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