

Case reports

Patient-centric treatment of acute trauma with Nexaris Angio-CT

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Results in other cases may vary.

Lead minimally-invasive procedures with multi-modal image guidance

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HyunSeok Jung, MD

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SungNam Moon, MD

Abbreviations:

SBP: systolic blood pressure

DBP: diastolic blood pressure

RBC: red blood cell

REBOA: resuscitative endovascular balloon occlusion of the aorta

ABGA: arterial blood gas analysis

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Case report #1 : Immediate bridging Intervention in a quickly changing situation



Dr. SungNam Moon

Patient history

A 55-year-old female patient presented to the emergency room after a traffic accident. Her physiological condition was stable with vital signs of 100 mmHg for systolic blood pressure (SBP), 60 mmHg for diastolic blood pressure (DBP), 70/min for pulse rate, and 16/min for respiration rate. The physical examination revealed no unusual findings except tenderness in the lower abdomen. She was able to undergo CT scan in the CT room of the Nexaris Angio-CT Therapy Suite (Hybrid OR) because of her stable physiological condition.

Patient management with Nexaris Angio-CT

The CT scan revealed an oval-shaped mesenteric hematoma in the left lower abdomen with no contrast extravasation (Figure 1-1). The initial decision of the trauma activation team including a 24/7 in-house availability of interventional radiologist was to slowly transfer the patient to the operation room without embolization. However, the patient's condition deteriorated rapidly as her blood pressure suddenly dropped. A bridging intervention was thus performed within 70 minutes of the patient arriving at the hospital, while the operating room was still being prepared.

After obtaining access via the right common femoral artery, an arteriogram of the superior mesenteric artery revealed a huge pseudoaneurysm (Figure 1-2a). This was embolized with coil and gelatin sponge particles (Figure 2b).

The patient's SBP/DBP returned to 120/80 immediately after the intervention. In the operating room, the hematoma was removed, and no other surgery was required (Figure 1-3). The operation site was clean and a total of just of just two packs of red blood cells were required for transfusion during the interventional and surgical procedures. She was discharged after hospitalization and rehabilitation treatment.

Comments

Traditionally, surgical operations have been the main treatment for a traumatic mesenteric injury. When she was transferred to the hospital, her condition was not critical to require an immediate transfer to the angio table of the Nexaris Angio-CT suite. However, the CT scan in the Nexaris Angio-CT suite quickly detected a mesenteric injury. In addition, rapid hemostasis as a bridging intervention before the surgical operation was available in case of a sudden increase in hypovolemia. Door-to-groin time was 70 minutes, which is very fast in this case. The patient recovered significantly after the embolization procedure. Other advantages to use Nexaris Angio-CT included being able to perform surgery immediately after pre-emptive embolization, being able to secure the surgical field of view and the lower volume of blood transfusion required.

With Nexaris Angio-CT, it was possible to provide a bridging intervention, as a new treatment paradigm for mesenteric injury, as well as an adaptive response to the quickly changing situation of the patient. An in-house interventional radiologist is needed for 24 hours a day so as not to delay interventional procedures, and an Angio-CT system is essential to perform a rapid procedure.

Although the treatment workflow of this case was very quick, each step was not as smooth as it might have been because, at the time, the Nexaris Angio-CT Therapy Suite had only recently been installed. If we had first used the angio table, more rapid treatment could have been possible without patient transfer and even faster workflow could have been available for this patient.

Diagnostic CT scan in the CT room of the Nexaris Angio-CT Therapy Suite

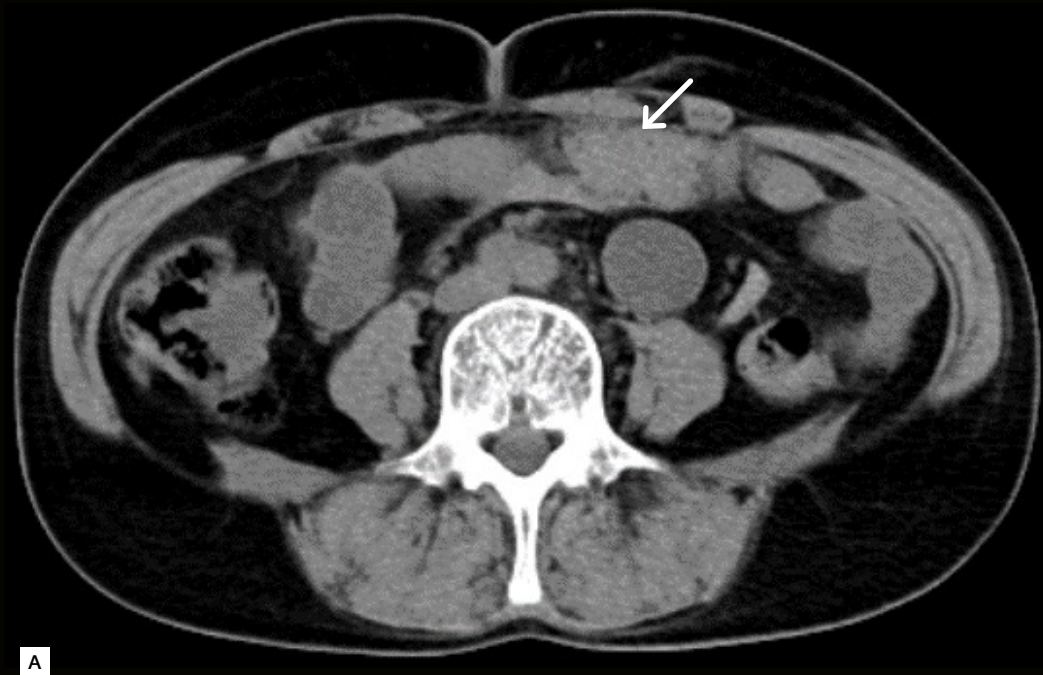
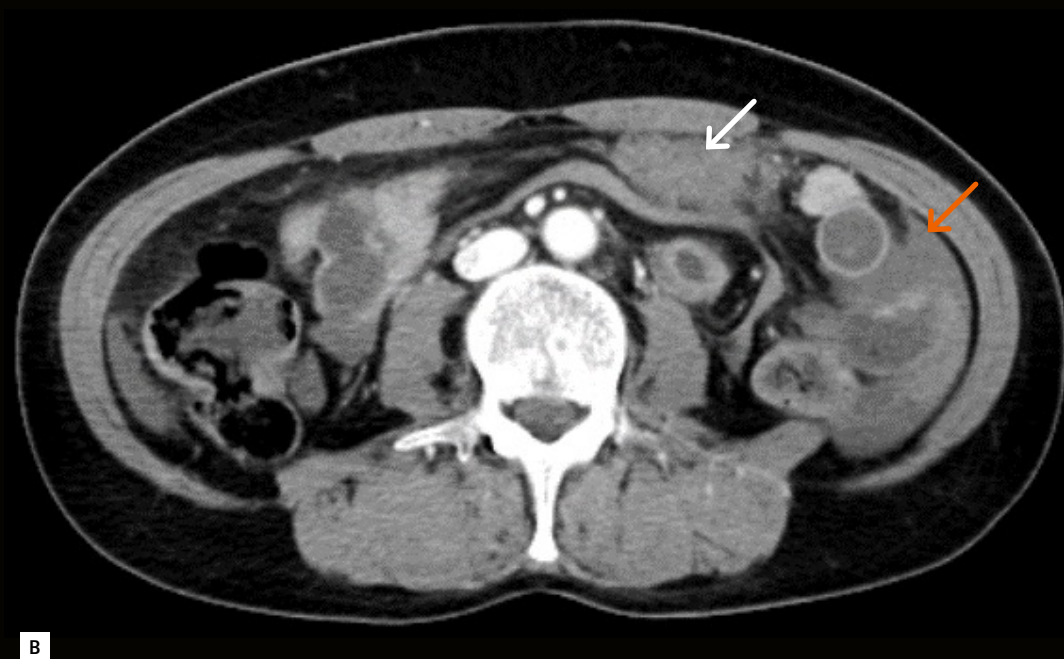


Figure 1-1

The CT scan showed:

- a huge mesenteric hematoma (white arrow in A)
- large amount of hemoperitoneum (orange arrow in B)
- no contrast extravasation (white arrow in B).



DSA arteriogram before and after embolization

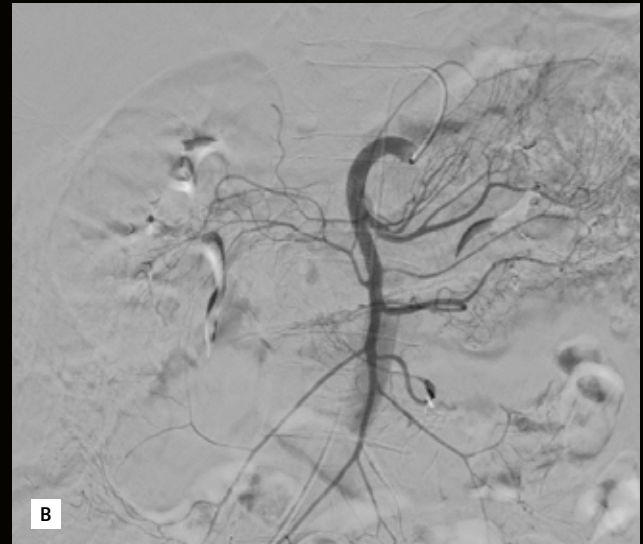


Figure 1-2

(A) The superior mesenteric arteriogram showed a pseudoaneurysm (arrow) at an ileal branch.

(B) No unusual findings revealed on follow-up angiogram after embolization with coils and gelatin sponge particles.

Surgical removal of the mesenteric hematoma

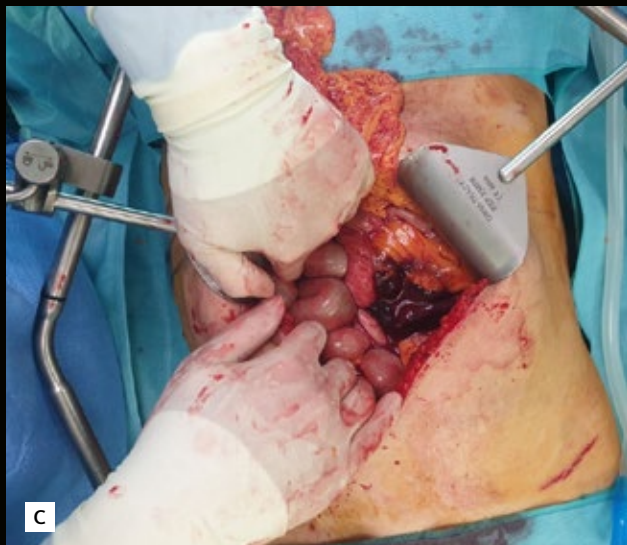


Figure 1-3

(C) The hematoma was removed and no other surgery was required. The operation site was clean and a total of just two packs of RBCs were required for transfusion during the interventional and surgical procedures.

Case report #2 : Door to groin in just 24 minutes



Dr. HyunSeok Jung

Patient history

A 52-year-old male patient fell from a height of 7 meters at a construction site. He was initially transferred to a hospital nearby and then to our hospital where he arrived an hour and a half after his traumatic accident.

Initial vital signs were 90 mmHg for systolic blood pressure (SBP), 40 mmHg for diastolic blood pressure (DBP), 105/min for pulse rate, and 20/min for respiration rate. A physical examination revealed multiple fractures of the left forearm and a fracture of the left pelvic bone. Immediate medical support (including massive transfusion protocol) and rapid radiological examination were required due to his unstable hemodynamic status.

Patient management with hybrid Angio-CT system

A whole-body CT scan was performed in the Nexaris Angio-CT suite. The CT scan revealed multiple pelvic bone fractures (of the left ilium, acetabulum, pubic rami), surrounding intramuscular and pelvic hematoma and, multifocal contrast blush (Figure 2-1). It was decided to proceed with endovascular treatment immediately.

After obtaining access via the right common femoral artery, multifocal contrast extravasation and contrast blush with AV fistula were found based on the initial left internal iliac arteriogram (Figure 2-2a). After microcatheter selection for both the left superior and inferior gluteal arteries, embolization with gelatin sponge particles was performed successfully (Figure 2-2b).

The patient's SBP/DBP returned to 120/80 immediately after the interventional procedure. He was discharged after the surgical operation and rehabilitation treatment.

Comments

Hemodynamically unstable trauma patients should be managed as quickly as possible. If there is bleeding, rapid hemostasis is essential. Although the patient was not transferred to our hospital until an hour and a half after his traumatic injury, a whole-body CT examination could be performed within just five minutes of his arrival, which confirmed that active bleeding had resulted in his unstable status.

With Nexaris Angio-CT, a transarterial embolization of bleeding is possible without moving the patient from one room to another (i.e., CT room to angio suite). In this case, it took just 24 minutes to obtain right common femoral artery access after patient arrival, the whole embolization procedure was completed in 54 minutes. The blood pressure of the patient recovered after the embolization procedure.

In this case, the Nexaris Angio-CT Angio-CT enabled immediate treatment after the diagnosis and contributed thus to the positive patient outcome.

Whole-body CT scan performed just five minutes after patient arrival



Figure 2-1

The CT scan showed:

- multiple pelvic bone fractures at left ilium, acetabulum, pubic rami;
- surrounding intramuscular and pelvic hematoma (solid circle);
- multifocal contrast blush (dashed circle).



A

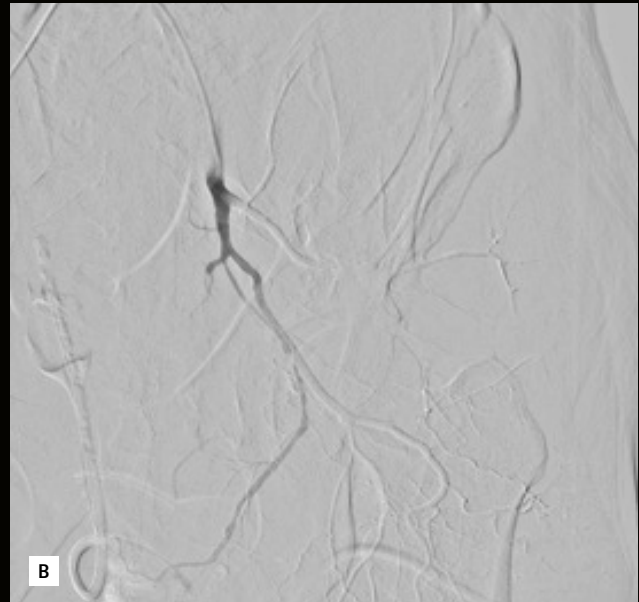


B

Right common femoral artery access just 24 minutes after patient arrival



Figure 2-2
(A) Multifocal contrast extravasation and contrast blush (circle) with AV fistula (arrow) were shown on the initial internal iliac arteriogram.



(B) After left superior and inferior gluteal artery embolization with gelatin sponge particles, a follow-up angiogram showed complete occlusion of target vessels.

Medical support, radiological examination, and intervention all in one room



Figure 2-3
With Nexaris Angio-CT, embolization of bleeding was performed immediately after the CT scan without the need to transfer the patient.

Case report #3 : REBOA under real-time fluoroscopy guidance

Patient history

A 50-year-old male was transferred to the emergency room after falling from a height of five meters. Immediately after arrival in the emergency room, the patient had a cardiac arrest. After cardiopulmonary resuscitation (CPR), the patient's blood pressure recovered to 64/42 mmHg. In the ABGA (arterial blood gas analysis) test, hemoglobin was 4.9 and pH was 6.99. REBOA (resuscitative endovascular balloon occlusion of the aorta) was performed while a balloon catheter was inserted via the right common femoral artery, followed by transarterial embolization.

Patient management with hybrid Angio-CT system

External CT showed an unstable pelvic bone fracture, L5 compression fracture, and multiple extravasation in both internal iliac arteries. In addition, multiple extravasations in both psoas muscles was noted (Figure 3-1).

REBOA was performed in zone III and balloon inflation was adjusted in accordance with the patient's blood pressure while monitoring in real-time fluoroscopy. Deflation and partial inflation were repeated during angiography (Figure 3-2).

Selective angiography confirmed multiple active bleeds (Figure 3-3). First, embolization of both internal iliac arteries was performed, but the patient's blood pressure did not recover. After that, embolization was performed on the lumbar arteries suspected to be the source of the bleeding. Next, embolization was performed on each of the suspect arteries in turn, and the patient's blood pressure recovered after embolization of the L2 to L4 lumbar arteries.

The size of the balloon was adjusted in real time, even during angiography, and the time for completing of REBOA reduced.

After the procedure, the patient's blood pressure recovered to 96/67 mmHg. In addition, the hemoglobin count returned to 10.6 through continuous transfusion during the procedure.



Dr. SangHyun Seo

Comments

REBOA insertion is currently performed in severe trauma patients, but has rarely been performed with real-time fluoroscopy.

The advantage of REBOA is that the balloon can be positioned correctly, and the degree of inflation can be seen exactly by the shape of the balloon. Under fluoroscopy guidance, the degree of inflation can be adjusted in real time to minimize full inflation time and reduce potential organ damage.

CT scan from external hospital

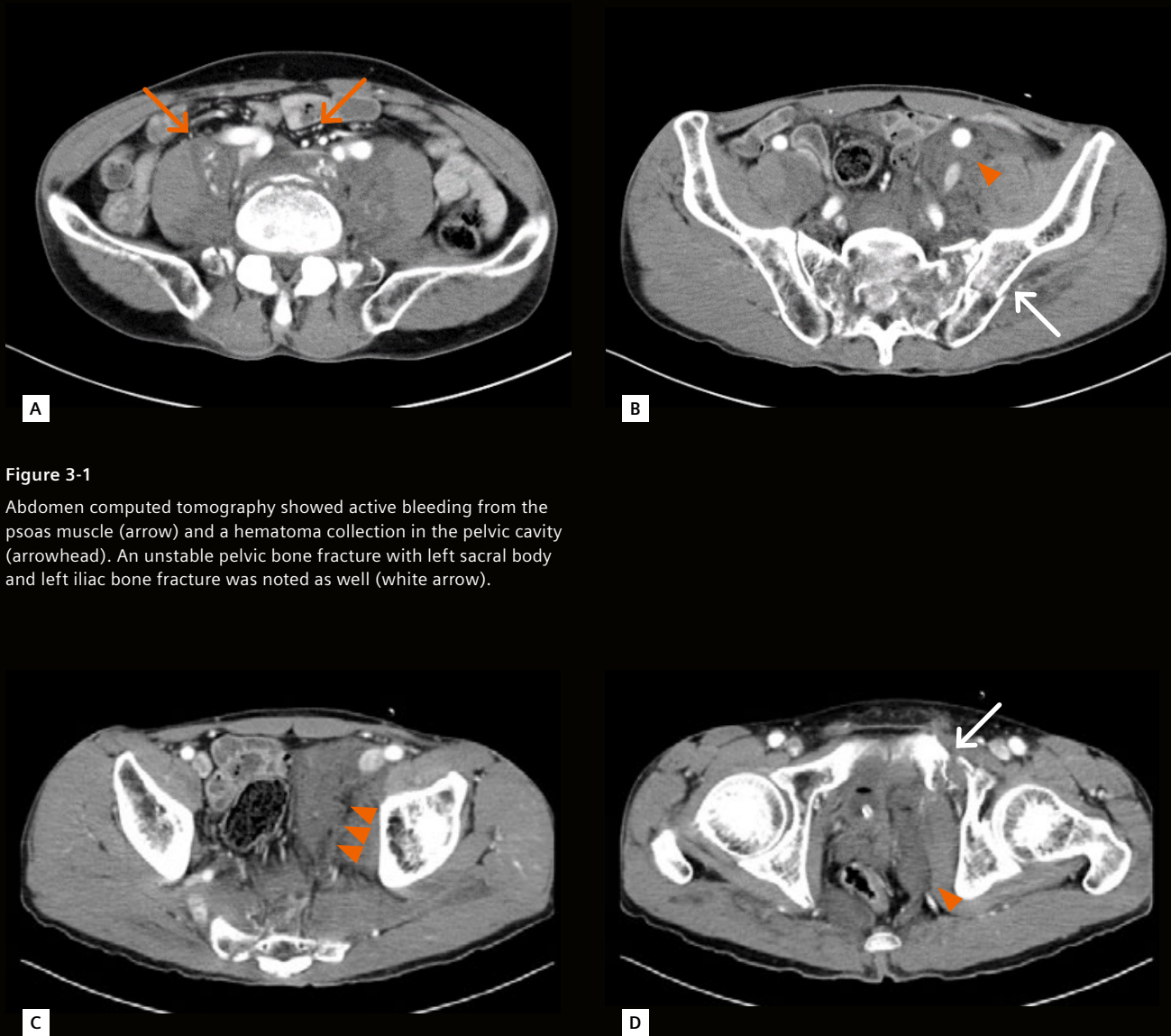


Figure 3-1

Abdomen computed tomography showed active bleeding from the psoas muscle (arrow) and a hematoma collection in the pelvic cavity (arrowhead). An unstable pelvic bone fracture with left sacral body and left iliac bone fracture was noted as well (white arrow).

REBOA under real-time fluoroscopy guidance

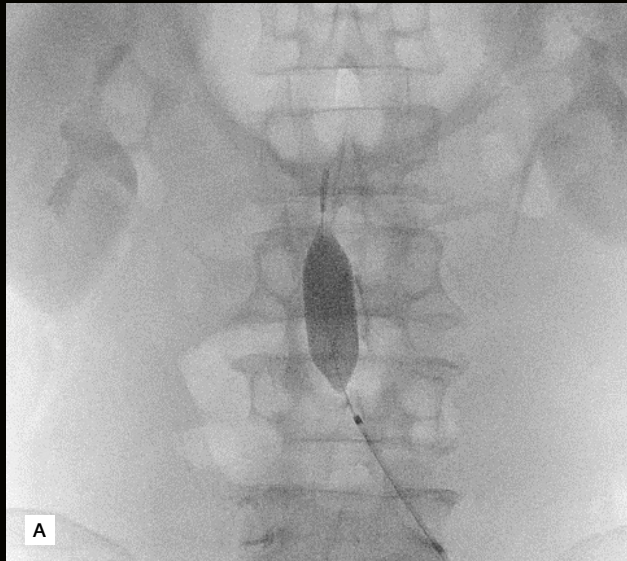
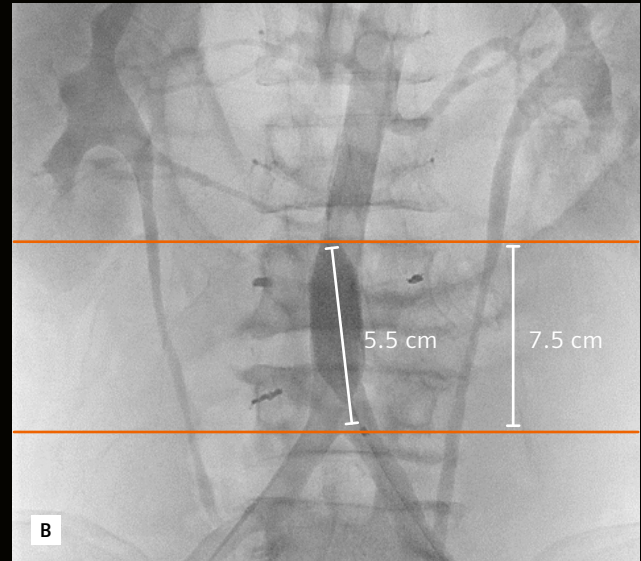


Figure 3-2
(A) Placement of REBOA in zone III through the left common femoral artery.



(B) Aortography marked with two red lines. The length of zone III was 7.5 cm in this patient, and the length of the fully inflated balloon was 5.5 cm. We could correctly locate the balloon catheter in zone III under real-time fluoroscopy guidance.



(C) Fully inflated balloon catheter

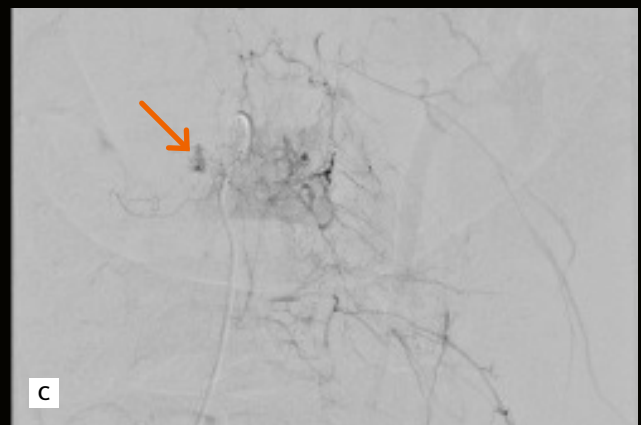
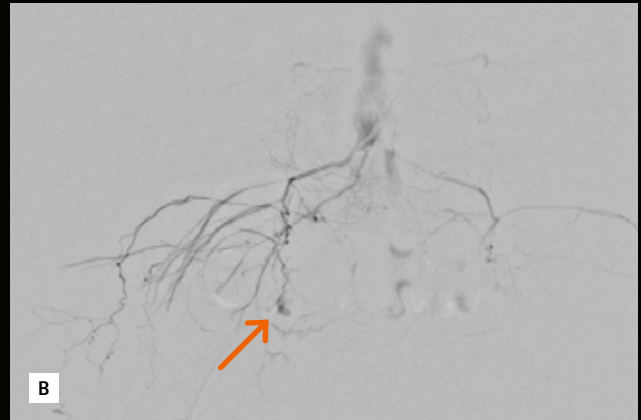


(D) Partially inflated balloon catheter

Selective angiography



Figure 3-3
Angiography showed active bleeding from the right internal iliac artery (A) and both lumbar arteries (B, C).



Angiography showed active bleeding from the right internal iliac artery (A) and both lumbar arteries (B, C).

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