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Successful embolization for a traumatic pseudoaneurysm concomitant with a massive back hematoma by a prone transradial catheterization technique

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ABSTRACT

A 25-year-old man with a massive traumatic subcutaneous hematoma in his back was transferred to our emergency department. Contrast-enhanced computed tomography revealed a pseudoaneurysm with extravasation within the hematoma. The patient was unable to take a supine position due to the massive back hematoma. We thus performed a transcatheter embolization of bilateral cervical branches with the patient in the prone position, via a radial artery. After two embolizations, successful hemostasis was achieved. The prone transradial catheterization technique is useful for embolization in patients who cannot be in the supine position.

Introduction

The benefit of performing transcatheter arterial embolization (TAE) for an acute bleeding event has been well established, and TAEs have been generally done with the patient in the supine position. However, in situations in which the patient is unable to take a supine position, catheterization in the lateral or supine position is required. There are a few reports demonstrating the utility of transradial catheterization in the prone position for intraoperative cranial angiography [1–3] and for preprocedural embolization for cryotherapy and biopsies [4,5], but emergency hemostasis is extremely rare. We herein here report the case of our patient who underwent successful embolization for a massive subcutaneous back hematoma by a prone transradial catheterization technique.

Case presentation

A 25-year-old man was referred to our emergency department for a massive subcutaneous hematoma of his back. He had injured his back falling down a flight of stairs. His medical history included neurofibromatosis type 1, but his family history was unremarkable. Prior to this presentation he was apparently healthy and asymptomatic. Upon his arrival at our hospital, he was conscious and alert, and his vital signs were as follows: blood pressure, 128/71 mmHg; heart rate 106 beats/min; respiratory rate, 13 breaths/min; percutaneous oxygen saturation by pulse oximetry, 97% under room air; body temperature, 37.9 °C. The physical examination confirmed the massive subcutaneous hematoma on the patient's back; he could not take a supine position. He also had many café au lait spots on his body, especially on his trunk.

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Laboratory findings revealed a hemoglobin level of 11.3 g/dL, white blood cell count of 14,500/μL, and platelet count of 2,170,000/μL. No abnormalities were detected in the serum biochemical and clotting tests. Contrast-enhanced abdominal computed tomography (CT) in the prone position revealed a massive subcutaneous hematoma (16 cm × 9 cm × 16 cm) in his back and a pseudoaneurysm with extravasation with the hematoma (Fig. 1). An emergency TAE was considered in order to achieve hemostasis; however, the TAE procedure needed to be performed with the patient in the prone or lateral position because he could not take a supine position due to the hematoma.

We thus decided to perform the TAE with the patient in the prone position. The patient was alert and had normal breathing; therefore, we could manage the patient's breathing without problems by turning his face sideways. A 4-Fr sheath (Terumo, Tokyo) was inserted through the right radial artery with prone position. A selective angiography of the right subclavian artery and its branches including the thyrocervical trunk and costocervical trunk was performed by using a 4.2-Fr Internal Mammary Artery (IMA) angiographic catheter (Goodman, Nagoya, Japan) with a coaxial system using a 1.7 Fr-microcatheter (Progreat® λ, Terumo) and no extravasation or pseudoaneurysm was observed. Subsequently, the left subclavian artery and its branch was selected via the aortic arch by the same catheters and a pseudoaneurysm was detected in the distal site of descending branch of costocervical artery (Fig. 2A). The selective TAE with gelatin sponge particles was performed (Fig. 2B). After the TAE, no appearance of the pseudoaneurysm or extravasation via the collateral circulation was confirmed on angiography of the bilateral subclavian arteries and these branches. The procedure was completed, and the sheath was removed.

However, the day after the TAE, an increase in the size of the hematoma and a decrease in the patient's hemoglobin level (7.9 g/dL) were observed. Contrast-enhanced CT was performed, revealing the increase in the hematoma's size to 22 cm × 9.5 cm × 1.9 cm in size and a small residual pseudoaneurysm within the hematoma. A second intervention with the patient in the prone position was therefore performed (Fig. 3).

A 4-Fr sheath (Terumo) was inserted through the left radial artery. A selective angiography of the left thyrocervical trunk with same catheters as 1st TAE revealed a pseudoaneurysm at the peripheral site of the descending branch of the transverse cervical artery (Fig. 4A, B). The selective TAE with gelatin sponge particles was performed (Fig. 4C). Subsequently, a selective angiography of right subclavian artery and its branches with the use of a Yumiko angiographic catheter (Goodman) that was developed for IMA angiography with a contralateral upper limb approach and a microcatheter was performed. No visualization of pseudoaneurysm or extravasation was confirmed. However, since the TAE of the left transverse cervical artery alone was concluded to be insufficient due to the proximal embolization, we performed selective CT angiography of the right transverse cervical artery via the microcatheter to confirm the collateral anastomosis. Thus, a pseudoaneurysm was visualized on the peripheral side of the descending branch (Fig. 4D, E), and TAE with gelatin sponge particles was performed (Fig. 4F). Finally, we confirmed the absence of visualization of the pseudoaneurysm on selective angiography of the bilateral subclavian arteries and theses branches again, and the procedure was completed. After this second TAE, there was no increase in the size of the hematoma or decrease in the patient's hemoglobin level, and he discharged 2 days after the second TAE. One month after the discharge, the patient underwent elective surgery for resection of the hematoma and skin grafting. The postoperative course was uneventful.

Discussion

The effectiveness of TAE for emergency bleeding has been well established, and the TAE procedure is generally performed with the patient in a supine position. TAE is generally performed with a transfemoral artery approach, but the radial or brachial artery approach

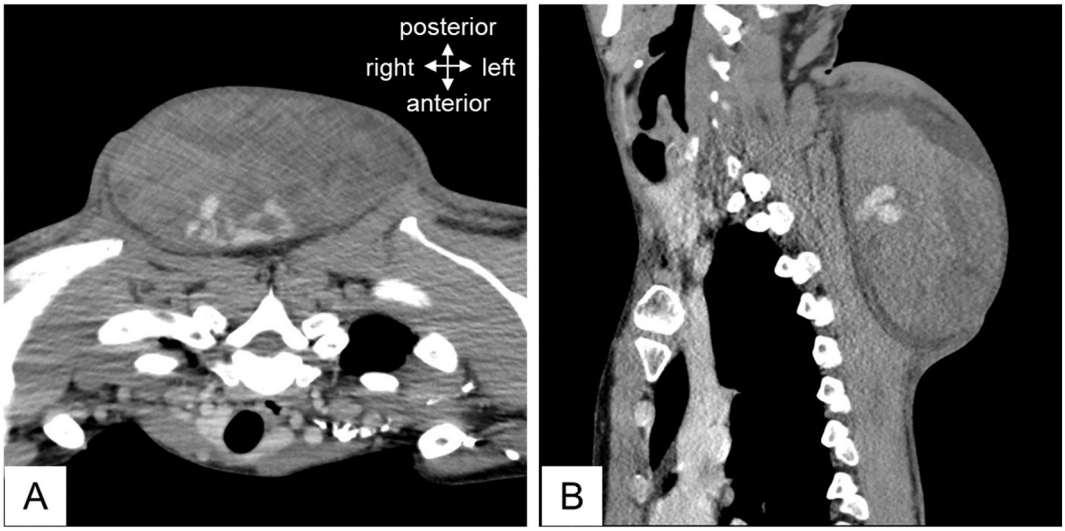

Fig. 1. Contrast-enhanced CT images in the prone position upon the patient's arrival in our emergency department. A: Axial image. B: Sagittal image. The massive subcutaneous hematoma with extravasation on the patient's back was noted.

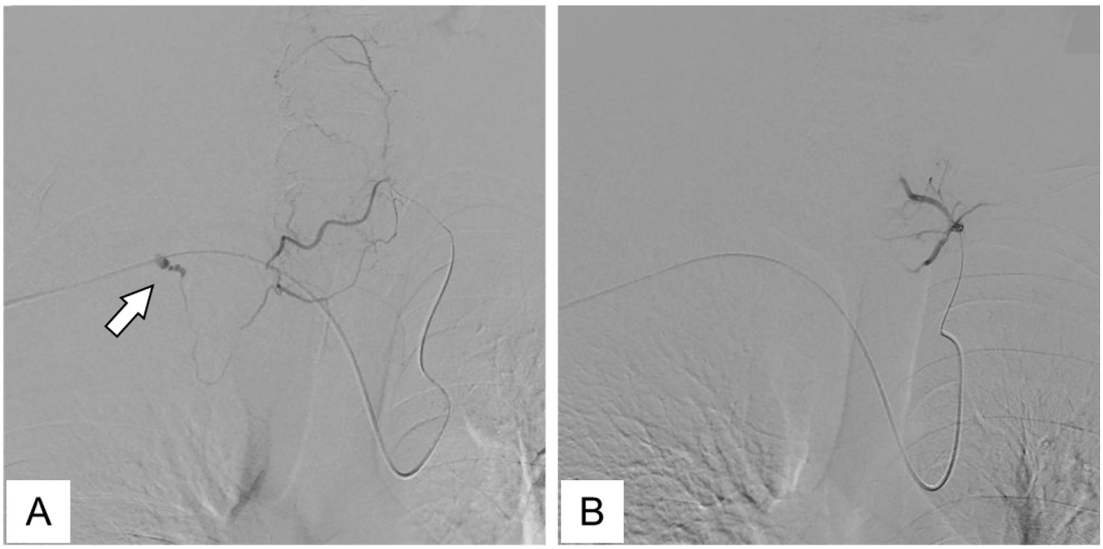

Fig. 2. Angiographic images at the first TAE. A: Selective angiography of the left costocervical artery. A pseudoaneurysm in the peripheral site of the descending branch was noted. B: Post-embolization image. No visualization of the pseudoaneurysm was observed.

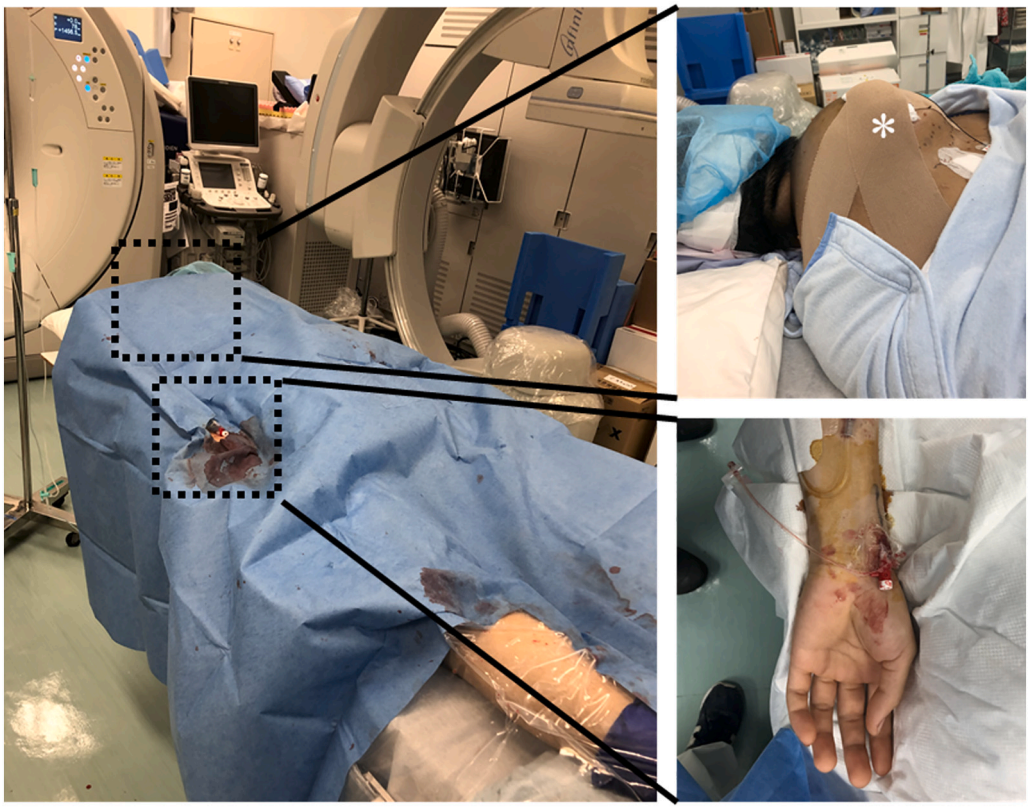

Fig. 3. Use of the prone transradial technique to perform embolization in a hybrid CT and angiography suite. Asterisk indicates the back hematoma.

is used in some cases, such as those in which a femoral approach cannot be used and cases of TAE for cervical or chest wall lesions. Situations that require a procedure with the patient in the prone position are rare, but it may occur when the patient cannot be in the supine position due to a back lesion, as in our patient's case. Although there are a few reports that demonstrate the feasibility of angiography and TAE in the prone position with a transradial artery approach for an elective procedure such as intraoperative

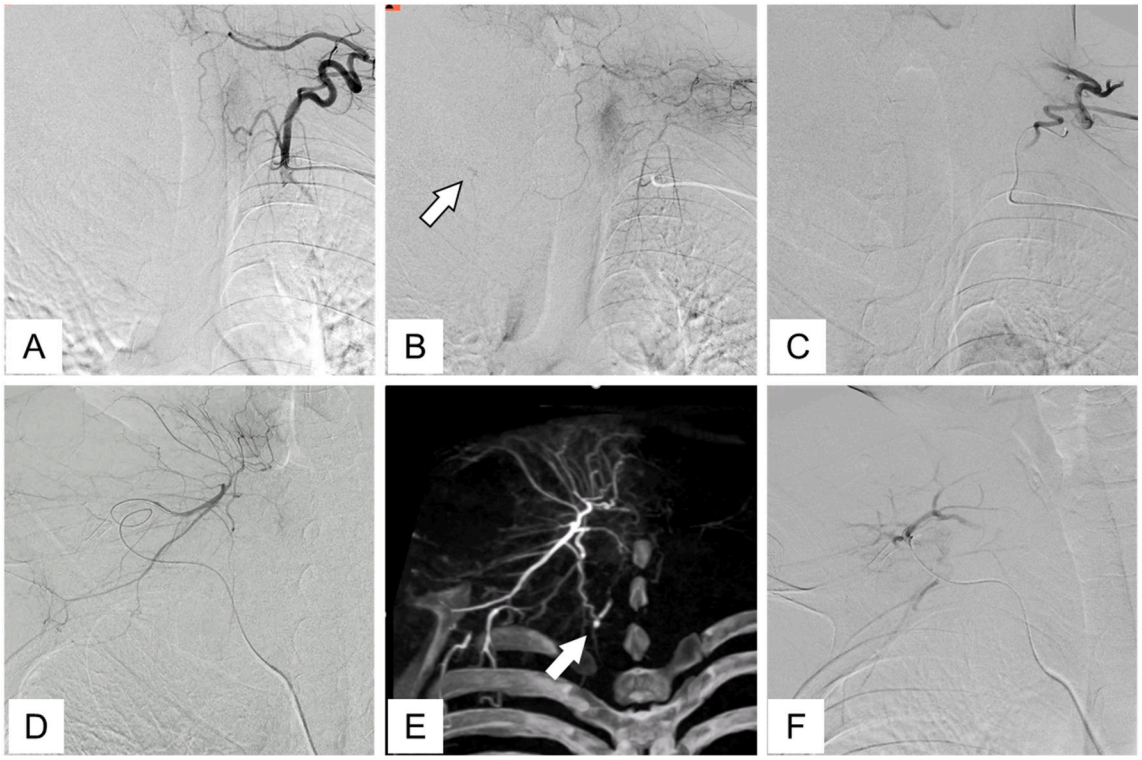

Fig. 4. Angiographic images at the second TAE. A, B: Selective angiography of the left thyrocervical trunk. A pseudoaneurysm at the peripheral site of the descending branch of the transverse cervical artery was noted (*arrow*). C: Post-embolization image. The pseudoaneurysm had disappeared. D: Selective angiography of the right transverse cervical artery. Note that a pseudoaneurysm was not visualized. E: Transcatheter selective CT angiography of the right transverse cervical artery. A pseudoaneurysm at the peripheral site of the descending branch was noted. F: Post-embolization image.

angiography of cranial and spinal arteries [1–3] and preprocedural embolization for cryotherapy and biopsy with a posterior approach [4,5], reports of this technique for an emergency case are very rare.

We conducted a literature search using PubMed, and we identified the case of only one patient who underwent emergent TAE for postsurgical life-threatening bleeding after the resection of an axillary tumor [6]. In that case, the authors performed a coil embolization of several branches of the subclavian artery by the ipsilateral approach. In our patient's case however, it was necessary to select the bilateral subclavian arteries and its branches via a single access route, and the complete hemostasis could be achieved. Our patient's case indicates the potential for a further expansion of the application of the prone transradial catheterization technique for emergency embolization in patients who cannot be in the supine position and has one or more lesions involving bilateral cervical arteries.

In the present case, an alternative embolization technique with another body position and access route such as a lateral recumbent position or a three-quarters prone position with popliteal artery access or brachial artery access could have been considered. However, in the lateral recumbent and three-quarters prone positions, there are considerable disadvantages including the difficulty of obtaining an appropriate working angle for fluoroscopy and the complexity of catheter operation due to the flexed limb position. In addition, popliteal artery access theoretically may have more access-site complications and is far from the cervical arteries. The brachial artery approach is also difficult in the prone position. We thus chose the prone transradial catheterization technique.

On the other hand, a transradial artery approach (particularly when catheterizing contralateral cervical arteries) has several considerable drawbacks, including the potential for cerebral infarction and the difficulty of catheterization compared to the transfemoral approach. However, a cerebral infarction can also occur with the transfemoral artery approach as was used in our patient's case. To avoid the risk of cerebral infarction, systemic heparinization should be considered, but its use in bleeding cases is challenging. Alternatively, the bilateral transradial artery approach may reduce the risk of cerebral infarction, but it is invasive and involves the complexity of the procedure. In our patient, TAE was performed without heparinization after obtaining informed consent form the patient regarding the risks of cerebral infarction and bleeding exacerbation. Regarding the latter issue, it can be overcome by using a dedicated catheter such as a Yumiko catheter as in our patient's case.

In our case, the airway management during TAE was easy because the patient had normal respiratory status. However, in an emergency situation, particularly, in patients with endotracheal intubation, the airway management in the prone position might be complicated. In such cases, TAE in alternative body positions, such as the lateral recumbent position and the three-quarters prone position, should be considered although these positions have some drawbacks, as described above.

Two TAEs were required for our patient to achieve complete hemostasis of the pseudoaneurysm, although we confirmed the

absence of visualization of the pseudoaneurysm by the selective angiography of the bilateral cervical branches, which can form an anastomosis with the culprit artery of the pseudoaneurysm. We speculate that the cause of this phenomenon was that the pseudoaneurysm itself was not embolized in the first TAE because of the proximal embolization of the culprit artery. Ideally, the distal and proximal arteries of the pseudoaneurysm should have been embolized, but we were unable to reach the distal artery of the pseudoaneurysm because it was very thin and markedly tortuous. In such cases, embolization with a liquid embolic agent such as n-butyl-2-cyanoacrylate with lipiodol can also be considered, but we hesitated to use such an agent because there is a risk of the unintentional migration of the embolic agent to cerebral arteries. In the present case, we achieved complete embolization without any complications by identifying the anastomotic branch with the use of transcatheter-selective CT angiography during the second TAE. This technology may be useful for the detection of culprit arteries that cannot be identified by conventional angiography.

Conclusion

We described the case of a traumatic pseudoaneurysm concomitant with a massive subcutaneous hematoma of the back in which hemostasis was achieved by TAE with a transradial catheterization technique and the patient in the prone position. This technique may be useful for TAE in patients who cannot take a supine position.

Declaration of competing interest

The authors declare that they have no conflicts of interest.

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