



CT-Guided Percutaneous Thrombin Injection of Posttraumatic Aortic Branch Pseudoaneurysm

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Abstract

A pseudoaneurysm of an aortic branch artery is a potentially life-threatening uncommon occurrence, which may result in retroperitoneal hemorrhage. Imaging-guided percutaneous thrombin injection has a high technical success and effectiveness rate for treating pseudoaneurysms of the femoral, iliac, and popliteal arteries. We present a case of a retroperitoneal hemorrhage in a patient with a periaortic branch pseudoaneurysm, potentially from an avulsed lumbar artery. Anatomy prevented fixation with a covered stent; the comorbidities eliminated safe surgical repair, and endovascular embolization was not an option due to the avulsion. Computed tomography (CT) fluoroscopy-guided thrombin injection provided a safe, successful embolization with no postprocedural complications.

Keywords

- ▶ aortic branch pseudoaneurysm
- ▶ lumbar artery pseudoaneurysm
- ▶ CT-guided thrombin injection

Introduction

Posttraumatic aortic branch pseudoaneurysms (PSAs) are uncommon¹ and are typically associated with high-energy, blunt force or penetrating trauma with injury to intra-abdominal structures, resulting in a potentially life-threatening retroperitoneal hemorrhage¹ The risk of rupture requires prompt treatment as no reliable predictive symptoms exist.²

The recommended treatment for PSA is catheter angiography with endovascular embolization or endovascular stent graft exclusion. The most common embolic materials are coils; other embolic materials, such as polyvinyl alcohol (PVA), acrylic microspheres, gelatin sponge, and n-BCA are less commonly used.² Imaging-guided percutaneous thrombin injection has been widely accepted³ as a treatment of femoral artery PSAs, with a suggestion for the broader use of thrombin for PSAs across other vessels.⁴

Here, we present a case of a retroperitoneal hemorrhage in an elderly patient presenting with a spinal fracture after a ground-level fall successfully treated with a computed tomography (CT) fluoroscopy-guided thrombin injection. Following institutional review board (IRB) approval and upon receiving publication consent, this report was completed.

Case Report

An 81-year-old woman with a history of breast cancer presented to the emergency department with abdominal and back pain after a fall from a standing position. CT examination demonstrated a right periaortic PSA at the T12/L1 level (2.1 × 2.1 × 2.7 cm; ▶ **Fig. 1**) and a compression fracture of the L1 vertebral body. No apparent communication of the PSA with any branch of the abdominal aorta

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Fig. 1 Contrast-enhanced computed tomography (CT) axial plane demonstrating a pseudoaneurysm (*white arrow*) adjacent to the abdominal aorta.

was noted, suggesting an avulsed origin of a lumbar artery or the right subcostal artery given the T12/L1 location, eliminating the potential for catheter angiography and coil embolization. The adjacent aortic branches, such as the celiac axis, made fixation with a covered stent technically challenging and, as the spinal artery arises from this location, induced an increased risk of paraplegia. The location of the PSA and the patient's comorbidities made surgical repair high risk.

Utilizing CT fluoroscopy guidance, a 10-cm 19-gauge needle (Argon Medical, Plano, TX) was advanced into the PSA with a prone right paravertebral approach (►**Fig. 2**). Pulsatile arterial blood emanated from the needle spontaneously. Reconstituted thrombin (0.5 mL; 500 units; Pfizer, New York, NY) was administered with cessation of blood from the needle. No blood could be manually aspirated with a 5-mL syringe after a 10- to 15-second wait period. The needle was removed. CT angiography (CTA) demonstrated a lack of contrast opacification of the PSA in the arterial (►**Fig. 3**) and the delayed phase of intravenous contrast enhancement. No procedural-related complica-



Fig. 2 Computed tomography (CT) fluoroscopy image demonstrating the right paravertebral approach of a 19-gauge needle into the pseudoaneurysm.



Fig. 3 Axial computed tomography (CT) angiography (arterial phase) demonstrating resolution of contrast enhancement of the pseudoaneurysm after thrombin injection (*white arrow*).

tions were observed. At 3.5 months postinjection, the patient was asymptomatic, and a CTA illustrated a successful embolization.

Discussion

While aortic branch PSAs are typically associated with blunt abdominal trauma with a spinal injury,¹ in an elderly patient, this should be considered a source of hemorrhage, even from a ground-level fall. On imaging, aortic branch PSAs present as an enhanced density close to the psoas major muscle, the lumen enhancing similar to that of the aorta.^{1,5} A literature review of 26 cases (►**Table 1**) noted that all reports but two used embolization. Our report notes the limitations of the anatomy and lack of PSA communication with any abdominal aortic branch, suggesting an avulsed origin. This makes it impossible to catheterize the visceral aortic branch PSA endovascularly, and coil embolization was not feasible. The use of other embolic agents, such as glue or Onyx, would have required visualization, which was not a possibility in our case. Also, these embolic agents typically require larger volumes, risking reflux; glue would have been an unsafe option due to the possibility of attaching the needle to the PSA, risking a tear. While direct percutaneous injection of thrombin has been the preferred treatment for postcatheterization femoral artery PSAs,^{2,3} it has had limited use in aortic branch PSA, except when embolization is not an option.^{2,5} Given these data, thrombin appeared to be the safest option for this patient. A small amount of thrombin was administered initially to prevent reflux into the abdominal aorta, which could have resulted in visceral and lower extremity thrombus. Preparations were made for repeated small injections with repeated contrast-enhanced CT imaging if the first dose was ineffective; fortunately, this was unnecessary.

Given the favorable outcomes at other sites and that aortic PSAs are life-threatening, thrombin is a viable option for this site.

Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of

Table 1 Survey of reported lumbar artery pseudoaneurysms

| Study | Age | Cause | Presentation | Resolution |
|-------------------------------------|-----|--|----------------------------|--------------------|
| Ikubo et al ⁶ | 62 | Blunt trauma | Abdominal pain/hypotension | Embolization |
| Siablis et al ⁷ | 45 | Fall from 6 m | “Agonizing pain” | Embolization |
| Chan and Korivi ⁸ | 24 | Gunshot | Low back/flank pain | Embolization |
| Kessel et al ⁹ | 21 | Penetrating abdominal trauma | Missed during laparotomy | Embolization |
| Lee et al ¹⁰ | 47 | Fracture of lumbar spine | Hypotensive shock | Embolization |
| Domenicucci et al ¹¹ | 23 | Thoracolumbar vertebral dislocation | Anemia/hemorrhage | Embolization |
| Ramsay and Marshall ^{12,a} | 23 | Renal biopsy | | Thrombin |
| Sharma et al ^{5,a} | 47 | Spontaneous | Abdominal pain | Thrombin |
| Tomescot et al ¹³ | 79 | Osteomyelitis | Acute back pain | Embolization |
| Oh et al ¹⁴ | 55 | Lumbar posterolateral fusion | Retroperitoneal Hemorrhage | Embolization |
| Counihan et al ¹⁵ | 18 | Knife stab | Bleeding | Embolization |
| Suresh et al ¹⁶ | 60 | Postpercutaneous coronary intervention | Back ache/hypotensive | Embolization |
| Tsekouras et al ¹⁷ | 64 | Inferior vena cava filter | Abdominal pain | Embolization |
| Djuimo et al ¹⁸ | 21 | Nephrostomy removal | Bleeding on removal | Embolization |
| Giordano et al ¹⁹ | 73 | Cryoablation/vertebroplasty lumbar met | Abdominal pain | Embolization |
| Vashisht et al ⁴ | 32 | Lumbar/spine fracture from fall | Hypotensive shock | Symptom management |
| Salam and Khandwala ²⁰ | 71 | Renal biopsy | Hemodynamic instability | Embolization |
| Panagiotopoulos et al ²¹ | 39 | Lumbar discectomy | Abdominal pain | Embolization |
| Latka et al ²² | 58 | Postlumbar fusion | Abdominal pain | Embolization |
| Méndez et al ²³ | 72 | Postlumbar fusion | Monoplegia abdominal pain | Embolization |
| Eissa et al ²⁴ | 30 | Fall from 2 m/postlumbar fusion | Back pain | Embolization |
| Ruffilli et al ²⁵ | 53 | Postlumbar fusion | Back pain | Embolization |
| Keerthivasan et al ²⁶ | 80 | Postlumbar fusion | Leg pain | Embolization |
| Kim et al ²⁷ | 73 | Postlumbar fusion | Swelling of leg | Stent graft |
| Nam et al ²⁸ | 62 | Postvertebral augmentation | Back pain | Embolization |
| Nam et al ²⁸ | 88 | Postvertebral augmentation | Back pain | No intervention |

Note: The table provides a survey of reported lumbar artery pseudoaneurysms, as this was the most likely location in our patient.

^aThe only report of thrombin injections for an aortic branch (lumbar artery) pseudoaneurysm.

the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

This study has obtained IRB approval from (Prisma Health), and the need for informed consent was waived. Dr. Devane is a paid speaker for Johnson and Johnson and TriSalus Life Sciences and is a consultant with Boston Scientific and Guerbet.

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None.

Conflict of Interest

None declared.

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