Spine

SPINE Volume 40, Number 7, pp E439-E441

CASE REPORT

Abdominal Aortic Injury During Vertebroplasty

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Study Design. Case report.

Objective. To describe an intraoperative complication occurring from abdominal aortic penetration during a vertebroplasty procedure for vertebral fractures on Th12 and L1.

Summary of Background Data. A vertebroplasty is a minimally invasive and widely performed procedure in elderly and high-risk patients, although there is a risk of life-threatening complications including aortic injury. However, little is known about the treatment of iatrogenic aortic penetration occurring during a vertebroplasty.

Methods. An 80-year-old female underwent a scheduled vertebroplasty procedure. When the needle was advanced into the L1 vertebral body, arterial blood spurted out from the needle hub and fluoroscopic imaging revealed penetration of the aorta. To minimize bleeding, we depressed blood pressure and kept the needle in place. While vital signs were maintained, we prepared for blood transfusion and circulation monitoring and consulted a cardiothoracic surgeon and a cardiologist. Contrast medium injected *via* the needle revealed that a hematoma had formed to shift the aortic wall beyond the needle. Circulation was stable while pressure of the needle decreased, thus the hematoma was thought to have become coagulated and the needle was cautiously withdrawn.

Results. After placing the patient in a supine position, aortic angiography revealed no leakage around the aorta and she was transferred to the intensive care unit. On postoperative day 1, no leakage around the aorta was confirmed on computed tomographic scans and the patient was extubated. During the 2-year follow-up period, no arterial complication was observed.

Conclusion. Conservative treatment is optional for accidental aortic penetration during a vertebroplasty when a tamponade effect is expected. In cases with circulatory collapse, when the tamponade effect seems insufficient or a free wall rupture is suspected, prompt removal of the needle and surgical repair should be considered.

Key words: vertebroplasty, percutaneous vertebroplasty, balloon kyphoplasty, rare complication, aortic injury, anesthetic management, needle pressure, elderly patient, prone position, conservative treatment.

Level of Evidence: 5

Spine 2015;40:E439–E441

Percutaneous vertebroplasty and balloon kyphoplasty (BKP) are minimally invasive procedures with excellent outcomes and are widely performed.[1] However, rare but life-threatening complications such as pulmonary embolism, anaphylaxis by cement, and major vessel injury are possible.[2–6] We describe a case of aortic penetration by a needle during a vertebroplasty procedure that was successfully treated in a conservative manner.

CASE REPORT

The patient was an 80-year-old female scheduled for BKP on Th12 and percutaneous vertebroplasty on L1 for vertebral fractures due to osteoporosis under general anesthesia. She was intubated and placed in a prone position. Two pairs of needles (14G, bone access needle, KYPHON BKP System; Medtronic, Minneapolis, MN) were inserted into the vertebral body at Th12 and L1, respectively. However, when the inner cylinder of the L1 needle was removed, arterial blood spurted out. Fluoroscopic imaging with contrast medium revealed that the tip of needle had penetrated the posterior wall of the descending aorta (Figure 1). To minimize aortic injury and bleeding, we administered a muscle relaxant to immobilize and a depressor and then secured the additional venous and arterial lines. Meanwhile, a cardiothoracic surgeon and a cardiologist were consulted and the patient was prepared for emergency aortic repair surgery procedures. Contrast medium injected *via* the needle revealed that a hematoma had formed to push the aortic wall away from the needle (Figure 2), although her vital signs were stable. Because aortic pressure and its wave form measured at the needle tip had faded, the hematoma was assumed to be coagulated. We assumed that bleeding was minimal and then decided to treat the patient in a conservative manner.

Fifty-five minutes after the penetration, we carefully withdrew the needle and kept the patient in a prone position to

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Acknowledgment date: September 14, 2014. First revision date: November 25, 2014. Second revision date: December 23, 2014. Acceptance date: December 31, 2014.

No funds were received in support of this work.

No relevant financial activities outside the submitted work.

The device(s)/drug(s) is/are FDA-approved or approved by corresponding national agency for this indication.

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DOI: 10.1097/BRS.0000000000000780

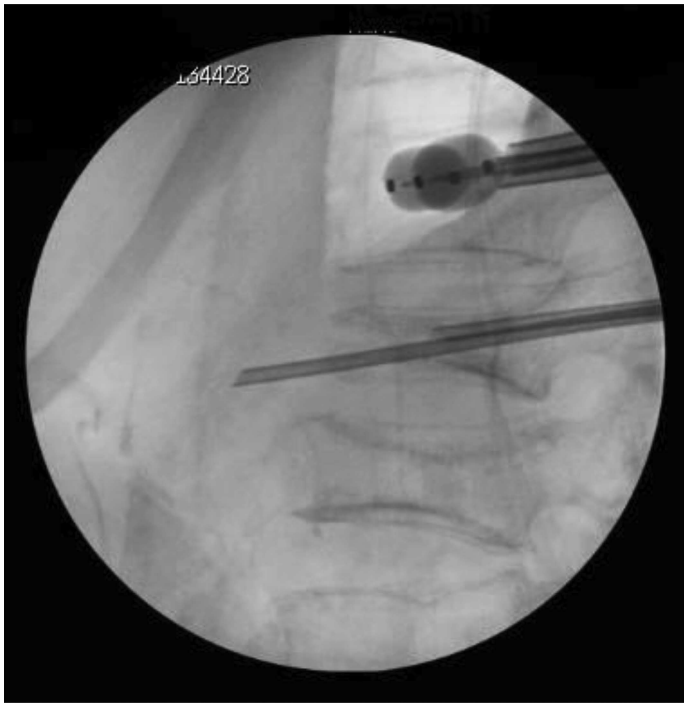

Figure 1. Tip of the needle inserted into L1 located beyond the ventral margin of the vertebral body and penetrating the posterior wall of the descending aorta.

secure hemostasis. While waiting for blood coagulation, we continued BKP on Th12 because the needle had already been inserted. Ninety minutes after the penetration, the patient was placed in a supine position. After no extravasation was confirmed by aortic angiography (Figure 3), she was transferred to the intensive care unit. On postoperative day 1, neither extravasation nor progression of the hematoma was seen on computed tomographic (CT) scans, thus we extubated the patient. Follow-up CT scans on postoperative day 10 revealed that the hematoma was not enlarged (Figure 4). The patient was discharged without any sequela on postoperative day 21. During the 2-year follow-up period, no arterial complication was observed.

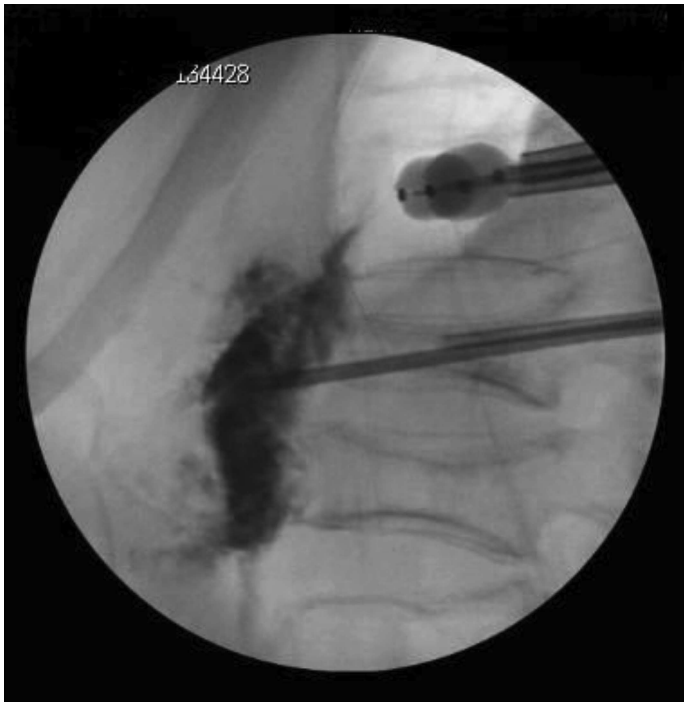

Figure 2. Fluoroscopic imaging with contrast medium administered from the needle that has penetrated through the body of L1. A hematoma had formed to push the aortic wall.

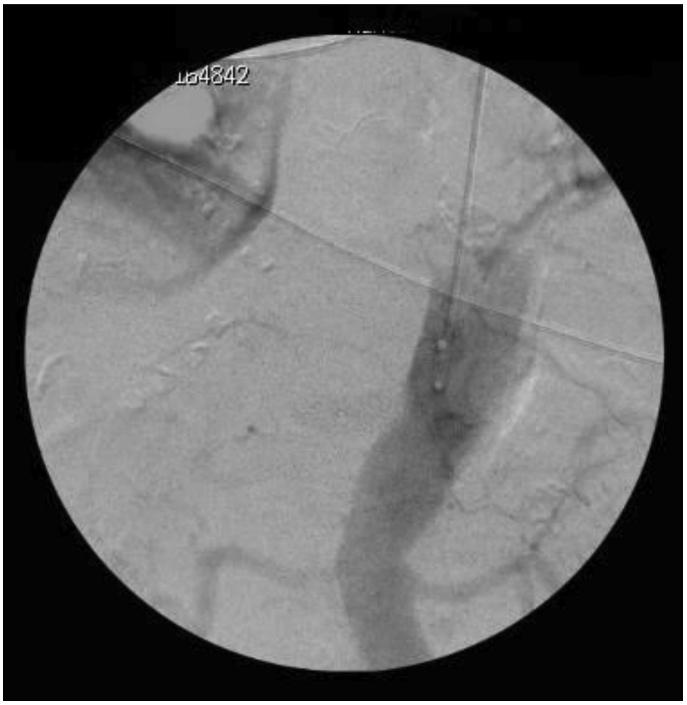

Figure 3. No extravasation was seen in aortic angiographic findings.

DISCUSSION

Little is known about treatment of an aortic injury that occurs during a vertebroplasty procedure. We have reviewed and compared the similar cases (Table1). Hard *et al*[6] reported a case of aortic injury during a vertebroplasty procedure, although the

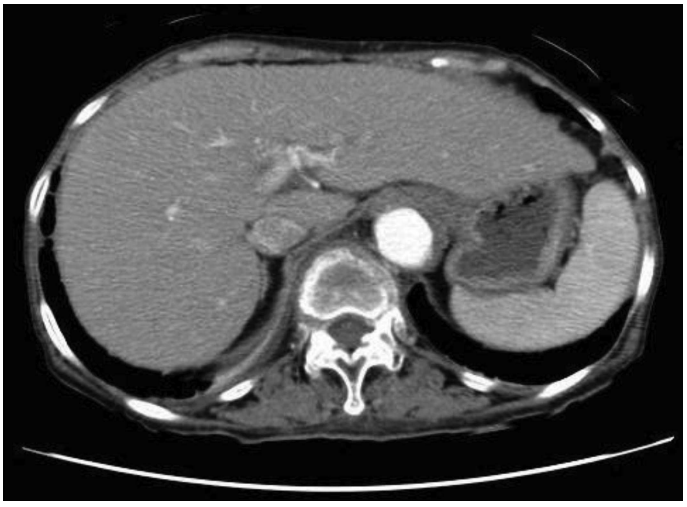

Figure 4. Axial contrast-enhanced computed tomographic scan obtained on postoperative day 10. No leakage was found and the hematoma had become absorbed.

TABLE 1. Cases of Major Vessel Injury After Vertebroplasty

Study	Patient	Disease	Diagnosis	Treatment	Result
Hard *et al*[6]	73, F	Th5 osteoporotic compression fracture	Thoracic aorta injury, only adventitia	Cement injection	Uneventful 2 yr
Puri *et al*[5]	67, F	L3, L4 compression fractures	Lumbar artery pseudoaneurysm	Coil embolization	Not available
Puri *et al*[5]	81, F	Th11, L1–L3, L5 compression fractures	Lumbar artery pseudoaneurysm	Coil embolization	Not available
This study	80, F	Th12, L1 osteoporotic compression fractures	Abdominal aortic penetration	Conservative treatment	Uneventful 2 yr

injury remained within the adventitia. In that case, cement was injected to cover the area around the injured aorta site. In contrast, cement injection into the hematoma was thought to be ineffective in our case, because the significantly sized penetration hole might not have been completely covered, and also to induce a cement embolism. Furthermore, injected cement can have an irregular shape within hematoma, thus can cause injury to the aortic wall after hematoma was absorbed.

As treatment of iatrogenic aortic penetration during spinal surgery, it has been reported that immediate removal of the instrument should not be performed because significant bleeding from aortic perforation is difficult to control with the patient in a prone position.[7] In the present case, we held the penetrated needle, and vital signs were maintained to prepare for circulatory support and vascular surgery. Holding the penetrated needle and inducing hypotension might have reduced the area of the penetration hole, thus reducing bleeding and promoting coagulation. A lowering of aortic pressure is also important to reduce the risk of aortic dissection. It is noteworthy that holding the penetrated needle was also useful for administration of contrast medium, aortic pressure measurement, and monitoring of coagulation.

The severity of aortic injury can be estimated either by imaging or clinically by circulatory status. In the present case, the aortic injury occurred in the posterior wall where a compartment effect would be expected. Because of stable vital signs and no extravasation in angiography findings, we chose conservative treatment rather than urgent aortic repair.

As for postoperative management, continuance of reduced blood pressure and immobilization seem to be justified until hemostasis is confirmed. Although the postoperative course of our patient was uneventful for up to 2 years, follow-up CT should be performed for aortic complications, which are known to occur in later periods.[8]

The error occurred, although the protocol and the procedure were performed by a well-trained surgeon. Moreover, frequent imaging of the needle tip location using 2 fluoroscopic imaging devices did not prevent the aortic injury. As the patient was elderly and osteoporotic, which were thought to be risk factors for aortic injury (Table 1), her fragile vertebra allowed the needle to advance more than expected. To avoid this error, it is important to confirm the needle tip location, keeping in mind for bone brittleness.

In conclusion, we experienced a case of aortic penetration by a needle during a vertebroplasty procedure. Treatment should focus on evaluating the injury, minimizing bleeding, and preparing for possible urgent surgical repair. By holding the needle in place, blood extravasation was reduced to stabilize circulation while it was also considered useful for contrast medium administration and pressure monitoring *via* the needle tip. Conservative treatment is an option when vital signs are stable and a tamponade effect is expected.

➢ Key Points

- ❑ We describe a case of abdominal aortic penetration by a needle through the anterior vertebral body wall during a vertebroplasty procedure.
- ❑ Although iatrogenic aortic injury by a needle is a rare complication, it can be life threatening.
- ❑ Induction of hypotension and stabilization of the penetrating needle were thought to be effective as initial treatment in this case.
- ❑ Conservative treatment can be applied when circulation is stable and hemostasis confirmed.

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