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Case Report

Nonaneurysmal Subarachnoid Hemorrhage : Rare Complication of Vertebroplasty

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On rare occasions, percutaneous vertebroplasty (PV) may be associated with adverse spinal and extraspinal events. Subarachnoid hemorrhage (SAH) has not been reported complication following a PV. This is a report of two elderly women with spine compressions who developed idiopathic SAH after injecting polymethylmethacrylate into the thoracolumbar region transcutaneously. PV was performed as an usual manner on prone position under local anesthesia for these patients. During the interventions, two patients complained of a bursting nature of headache and their arterial blood pressure was jumped up. Computed tomography scans revealed symmetric SAH on the both hemispheres and moderate degree of hydrocephalus. Any intracranial vascular abnormalities for their SAH were not evident on modern neuroangiography modalities. One patient received a ventricular shunt surgery, but both fully recovered from the procedure-related SAH. The pathophysiologic mechanism that induce SAH will be discussed, with suggesting the manner that prevent and minimize this rare intracranial complication after PV.

KEY WORDS : Vertebroplasty · Complication · Nonaneurysmal subarachnoid hemorrhage · Valsalva maneuver.

INTRODUCTION

Percutaneous vertebroplasty (PV) with polymethylmethacrylate (PMMA) is rapidly being incorporated into the portfolio of spine surgeons and interventionists for treatment of painful fractures in the spine column with benign and malignant pathologies[9]. Although this percutaneous technique is a less invasive and maximally effective to the patients of spine compression, several procedure-related complications affecting the spine and its neuromusculatures, and extraspinal organs have been reported[7]. As a spinal complication following PV, new fractures at adjacent vertebrae, spinal roots and cord injury, neuritis, intramuscular and spinal epidural hematoma, infectious and inflammatory spondylodiscitis, spinal cord compression, and extravertebral cement leakage have been well-known[2,3]. Furthermore, this spinal procedure cannot be safe with unexpected events such as, chest contusion, rib fracture, pneumothorax, cement pulmonary embolus, stab injury to major vessels and pleurae, leg venous thrombosis, and problem of anesthesia[4,9,17]. Fortunately, however, extraspinal complication of vertebroplasty occurred remote from the puncture site is rare. With our best searches on literature, we could not find any report that describes the case of intracranial hemorrhage as complication of the PV. The authors herein report two cases of subarachnoid hemorrhage (SAH) following a minor percutaneous spine procedure and describe the pathophysiology of this rare cerebral complication.

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CASE REPORT

The first patient, a 74-year-old woman, who had acute osteoporotic compression fractures at the T10 and T11 vertebral bodies, was admitted to our hospital with severe backache. She had a prior history of spine treatment by injecting cement into the T12/L1 spines, with relief of her pain. At this time, PV was planned as a routine for two thoracic levels. After conscious sedation by intravenous analgesics, with extending both arms, the patient was placed in the prone position on a radiolucent table for the thoracolumbar area. Once positioned, we confirmed the fracture levels with previously obtained imaging studies and the level to be treated was localized by counting from above and below. After confirming the targeted vertebral body of

Fig. 1. A 74-year-old woman with multiple compression fractures on the dorsal and lumbar spines treated by vertebroplasty. Cement radioopacities are noted in the thoracolumbar spine bodies (A). Subarachnoid hemorrhage and intraventricular hemorrhage is demonstrated on cerebral computed tomography scan after spine procedure (B). Three-dimensional computed tomography angiography does not depict any vascular abnormalities (C).

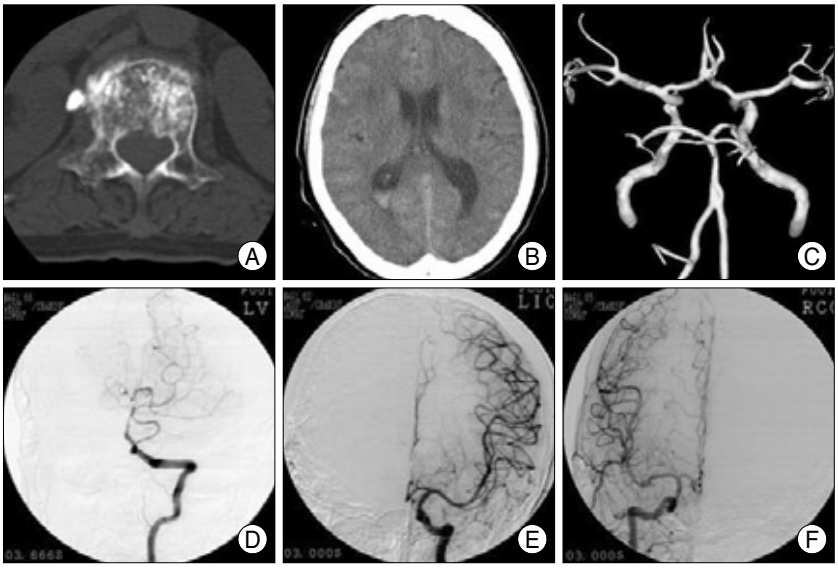

Fig. 2. A 65-year-old woman who complicated with nonaneurysmal subarachnoid hemorrhage following percutaneous vertebroplasty. Cement was leaked into the paravertebral muscles (A). Computed tomography after spine intervention shows subarachnoid hemorrhage and ventricular hemorrhage (B). Vascular lesions on the both carotid and vertebrobasilar trees except basilar artery fenestration are not detected on magnetic resonance angiography (C) and catheter angiography (D, E and F).

the T10 and T11 with C-arm fluoroscopy, the patient back was draped. A local anesthetics was infiltrated deeply, then intrapedicular guide needles were inserted on the both spines. During procedure, under electrocardiograhy monitoring, arterial blood pressure, respiratory rate, and oxygen saturation were also checked and recorded regularly. When the needle punctured the spine, patient had a transient episode of arterial hypertension, and she complained of discomfort in prone position and difficulties in respiration over the procedure of two and half hours. With the needle insertion and cement injection, she suffered from severe headache and vomiting. Computed tomography (CT) scans immediately taken after procedure revealed diffuse subarachnoid hemorrhage (SAH) and ventricular hemorrhage. None of causes of SAH were noted on the repeated three-dimensional CT angiography (3D-CTA) images, so that her hemorrhagic stroke was diagnosed as a nonaneurysmal SAH (Fig. 1). Two weeks later, she developed hydrocephalus and underwent ventricular peritoneal shunting. On follow-up examination, she fully recovered from her painful spine fractures and procedure related SAH.

The second patient, a 65-year-old woman who had osteoporotic compression body fracture in the first lumbar spine. This patient had a medical history of poorly controlled hypertension and diabetes. Under routine cardiac pulmonary monitoring and sedative infusion, we performed a PV on prone position to relieve her worsening back pain and walking difficulty. During procedure, cement leakage into the paravertebral tissue was noted on the fluoroscpy, and she exclaimed in excitement with sudden backache at that time. An episodic elevation of arterial hypertension was demonstrated on the monitor. Immediately, she presented with a bursting headache and then became disoriented and confused. Soon after the procedure, we scanned her head, and confirmed SAH in the both sylvian fissure. Any demonstrable intracranial vascular lesions for her SAH were not seen on the 3D-CTA, magnetic resonance angiography (MRA), and digital subtraction angiography (DSA) (Fig. 2). She had been treated conservatively and showed an ambulatory outcome without assistance.

DISCUSSION

For more than 10 years, with its advantage of minimalism, PV has been performed as a safe and effective procedure to reduce pain and encourage early ambulation for the patients with osteoporotic vertebral compression fractures[7]. However, it has been suggested that this minor intervention can be complex with procedure-related complications that may affect the spinal column itself and extraspinal systems occur acutely or lately[9,17]. Fortunately, most complications of PV are minor and infrequent. However, the incidence of these complications is likely to increase with the evolving popularity of PV. Even with an extensive review on literature,

there is no report on the complicated case with SAH and following vertebroplasty and kypholasty for spinal compression fracture or osteodestructive spine metastasis.

A spontaneous SAH occurs without angiographic abnormalities in about 10-20% of SAH patients, however, the causes and mechanisms of such bleeding remain unclear[8]. The verified causes of nontraumatic nonaneurysmal SAH were capillary telangiectasia, venous sinus stenosis, excessive strenuous exertion, benign perimesencephalic SAH, brain tumors, meningoencephalitis, Valsalva maneuver, coagulation disorders, severe arterial hypertension, and vasculitis[5,6,11,13,15,16]. Although the mechanism of its development is not clear, the arterial and/or venous hypertension during procedure, with resulting venous, capillary, or arteriolar bleeding, may proceed to SAH following PV. The placing the elderly patients on the uncomfortable table can put pressure on the peritoneum and the chest during procedure. Keeping the patient on the prone position, as on doing Valsalva maneuver, can induce increased intrathoracic pressure, which blocks the internal jugular venous return, resulting in elevated intracranial venous pressure or mechanical swelling of the intracranial veins, and leads to venous or capillary breakdown[1,8]. Secondarily, the authors speculated the transient arterial hypertension as the possible second cause of nonaneurysmal SAH after the PV[10]. Procedural pain and anxiety, associated the needle puncture, local anesthetic infiltration, and cement extravasation, can convulsively elevate the arterial blood pressure as noted in our patients.

In present cases, it is very likely that the association between two hours of procedure and the subsequent SAH is not coincidental. In order to reduce or eliminate the risk of complications, careful safeguards and technical modifications are needed for the PV with PMMA. First, because most candidates for the PV are elderly or have significant medical morbidities, the procedure should be moderately quick, especially in the patients of multilevel spine compression as like the first case. Second, we suggest that the identification of patient's cardiopulmonary problem which might restrict respiratory reservoir is very important for taking precaution against the Valsalva maneuver during PV under prone position. Third, to prevent a physical exertion during the intervention, related to the position, emotional stress, and anxiety and pain, some tactics that can enhance the patients' comfort and smooth patients' difficulties away are required. Forth, the patient's arterial pressure must be monitored intensively and strictly controlled during the whole procedure. Fifth, preoperative knowledge of a patient's ability to tolerate the prone position is an elementary to success in pain relief with PV for spine compression patients. Furthermore, it is wiser of us to use the customized spine table which is concave on abdomen contact area to reduce the abdominal pressure and to less likely develop the Valsalva maneuver[12].

In the clinical practice of PV, the 3D-CTA and/or MRA could be an effective and simple neuroimaging tools for screening the intracranial aneurysm in the PV candidates who are more likely to have it. Given the good outcomes on the nonaneurysmal SAH patients[14], we treated two cases with conservative manners including shunt surgery, and they well recovered from the spine fractures and PV-related SAH.

CONCLUSION

The PV is generally a safe and effective procedure to control pain associated with fractures of the spinal column. With the increasing popularity of PV, it is anticipated that more cases of intra- and extraspinal complications will be seen. Particularly for the elderly, we recommend that this procedure is only done while the patient is in a comfortable position, under intensive cardiopulmonary monitoring, with blood pressure control and adequate sedation and analgesia.

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