Percutaneous Intervention of the C2 Vertebral Body Using a CT-Guided Posterolateral Approach

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OBJECTIVE. The objective of this article is to present two cases of percutaneous biopsy and one case of vertebroplasty of the C2 vertebral body using a CT-guided posterolateral approach under local anesthesia.

CONCLUSION. The CT-guided posterolateral approach was safe, feasible, and effective for percutaneous intervention of the C2 vertebral body.

Keywords: CT, C2 vertebral body, percutaneous intervention, posterolateral approach

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mage-guided percutaneous interventions such as biopsy or vertebroplasty are well-established procedures and considered as substitutes for open surgery [1–6]. However, image-guided percutaneous intervention of the C2 body presents technical difficulties and requires caution to avoid potential injury of the vital structures that surround the C2 vertebra. Percutaneous intervention of the C2 body typically has been performed using the transoral approach, which requires general anesthesia [1, 6].

In our department, we have performed percutaneous biopsy or vertebroplasty of the C2 vertebral body using a CT-guided posterolateral approach under local anesthesia. To our knowledge, there has been only one previous report of the posterolateral approach for biopsy of the C2 vertebral body [4]. This article presents two cases of percutaneous biopsy and one case of vertebroplasty of the C2 body using a CT-guided posterolateral approach under local anesthesia.

Subjects and Methods

We performed two percutaneous bone biopsies for C2 vertebral body masses and one percutaneous vertebroplasty for a C2 malignant compression fracture using a CT-guided posterolateral approach between January 2005 and March 2007.

The first patient was a 57-year-old man. He visited our hospital with a sudden onset of neck pain, which had developed 2 months earlier. MRI of the cervical spine showed a tumor that was consistent with a malignant compression fracture at the C2 vertebral body (Fig. 1). The patient underwent surgery with occipito-cervical fusion by an orthopedic surgeon due to concerns about possible paraplegia. Due to the posterior surgical approach, the surgeon could not perform a biopsy on the C2 vertebral body during the operation and consulted our department for percutaneous biopsy to decide on further management after the operation.

The second patient was also a 57-year-old man. This patient was admitted to our hospital with posterior neck pain, which developed after an automobile accident. MRI of the cervical spine revealed an osteolytic expansile mass in the vertebral body, odontoid process, and the left pedicle of the C2 vertebra with a pathologic fracture. The lesion showed low signal intensity on T1- and T2-weighted images and showed prominent enhancement on contrast-enhanced MR images (Fig. 2). Differential diagnostic considerations included plasmacytoma, fibrous tumor, and giant cell tumor. This patient also was referred to our department for CT-guided percutaneous biopsy of the mass at the C2 body.

The third patient was a 49-year-old woman. She had advanced gastric cancer and was admitted to our hospital with severe neck pain that had begun 1 week before admission. An MRI showed extensive metastasis throughout the spine and an expansile mass with a malignant compression fracture at the C2 vertebral body and lateral mass (Fig. 3). In addition, because she could not hold up her neck without a supporting device, nor could she sit down or stand, it seemed that the malignant compression fracture at the C2 body was causing her neck pain and cervical instability. The patient could not undergo radiation therapy because she was unable to maintain a suitable position for the procedure without a supporting device. Therefore, she underwent one cycle of chemotherapy for 1 month. However, her pain persisted without any

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improvement. This patient was referred to our department for percutaneous vertebroplasty at the C2 vertebral body to relieve the neck pain and secure cervical stability.

The overall procedures were as follows. All patients were placed in the prone position and 1% lidocaine was infiltrated in the subcutaneous area at the selected needle puncture site after skin preparation. To identify the vertebral artery, contrast medium was administered intravenously. Then, a 25-gauge spinal needle was introduced targeting the left posterolateral corner of the C2 vertebral body and advanced in the anterior, cranial, and medial direction until bone contact was made under CT guidance. Next, 1% lidocaine was injected along the selected needle trajectory. During the needle progression, the thecal sac and vertebral artery were carefully assessed to avoid injury.

In the case of the bone biopsies, a 14G Bonop ty Penetration Cannula with a stylet (Radi Medical Systems) was introduced through the same route to the center of the C2 vertebral body and 0.8 mL of liquid and powder polymethylmethacrylate mixture (Vertebroplastic, DePuy International) was injected through the cannula using a 1 mL syringe. During this procedure, we carefully observed the cement filling and adjusted the injection rate and dose with CT fluoroscopy due to concerns about extra vertebral leakage into the epidural or foraminal space, or into the vessels (Fig. 3). The procedures, on average, lasted approximately 30 minutes.

Results
The biopsy specimens taken from the first and second patients were confirmed as plasmacytoma and fibrous dysplasia, respectively. The third patient who underwent percutaneous vertebroplasty described a subjective improvement of neck pain 2 days after the procedure and was able to sit down and stand after the procedure.

The first patient, who was confirmed as having plasmacytoma, and the third patient, who underwent percutaneous vertebroplasty, complained of mild neck pain after the procedure, but the pain was tolerable and did not last more than 1 day in both patients. The second patient, who had fibrous dysplasia, did not describe any remarkable symptoms. There were no procedure-related complications in any of the three patients.

Discussion
We performed two percutaneous bone biopsies and one percutaneous vertebroplasty for malignant compression fractures of the C2 vertebra without any complications.

The C2 vertebral body is surrounded by the larynx and pharynx anteriorly, carotid space laterally, vertebral artery and cervical nerve posterolaterally, and thecal sac posteriorly. During the interventional procedures, it is mandatory to avoid these structures due to the risk of severe neurovascular complications. Due to the potential risk of complications, a detailed and complete preprocedure radiologic evaluation, which includes the character of lesions (osteolytic or osteoblastic), precise location, degree of extension, and neighboring structures, is important.

Percutaneous intervention of the C2 vertebral body traditionally has been performed by the transoral route or sometimes via an anterolateral approach [1, 2, 6]. For the transoral approach, general anesthesia is mandatory. With the patient placed in the supine position...
with his or her mouth held open with a retractor, the needle is inserted through the posterior pharyngeal wall via the open mouth and advanced through the retropharyngeal space. There is a potential risk of injury to the vertebral artery and increased risk of infection compared with procedures using other approaches. Furthermore, the transoral procedure usually necessitates nasopharyngeal intubation [1, 2].

The anterolateral procedure is performed with the patient in a supine position, and the needle is transversed through the parapharyngeal, retropharyngeal, and prevertebral spaces [1]. The use of the anterolateral approach requires hyperextension of the head to elevate the mandible and also requires general anesthesia or at least sedation. Care should be taken to avoid injury of the submandibular gland, carotid space (carotid artery, jugular vein, and cranial nerves IX, X, XI), oropharynx, and vertebral artery. Reported complications after percutaneous vertebroplasty of the C2 vertebral body using the anterolateral approach include C2 neuralgia due to polymethylmethacrylate mixture leak and cerebellar infarction [2].

For the posterolateral approach, the patient is placed in the prone position and the needle is inserted through the posterior cervical space and advanced in the anterior, cranial, and medial direction. The posterolateral approach does not require general anesthesia, which can be hazardous to a generally debilitated patient. With this approach, there is a risk of injury to the vertebral artery. Before the procedure, the operator should review axial MR images carefully to see the course of the vertebral artery and to find a safe needle trajectory avoiding the vertebral artery. Care should be taken to ensure that the needle does not penetrate vertebral arteries during the procedure.

In conclusion, the CT-guided posterolateral approach is a safe, feasible, and effective method to perform percutaneous biopsy or vertebroplasty of the C2 vertebral body without the need for general anesthesia. This method could be useful in percutaneous intervention of the C2 vertebral body.

References