

Technical Report

Open microsurgical tumor excavation and vertebroplasty for metastatic destruction of the second cervical vertebra—outcome in seven cases

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Abstract

BACKGROUND CONTEXT: Metastatic osteolytic involvement of the second cervical vertebra (C2) is rare, but usually very painful. Percutaneous vertebroplasty has shown to be effective regarding pain control, but carries the risk of cement leakage.

PURPOSE: To describe an alternative microsurgical procedure suitable for patients suffering from C2 osteolysis who are considered to be high risk with respect to cement leakage.

STUDY DESIGN: A technical report.

PATIENT SAMPLE: It included seven patients.

OUTCOME MEASURES: They include the assessment of clinical safety regarding approach- and procedure-related morbidity and radiologic safety regarding extravertebral cement leakage and the assessment of clinical efficacy by monitoring the pain activity using the visual analog scale (VAS).

MATERIALS AND METHODS: Seven patients (five men, two women; mean age 70 years) presented with an acute onset of excruciating neck pain (VAS>6) due to osteolytic destruction of the axis vertebra. There was no neurologic deficit and no compression of the spinal cord preoperatively requiring surgical decompression or stabilization in any of the cases. An open treatment strategy via an anterolateral microsurgical approach was performed. Under biplanar fluoroscopic control, the soft tumor tissue was resected out of the vertebral body through a drilled entry in the anterior wall. After the excavation procedure, the resection cavity was filled with minimal pressure with polymethylmethacrylate bone cement.

RESULTS: All patients suffered from severe spontaneous neck pain (mean VAS 8.1, range 6–9), with head motion-dependent pain exacerbation despite high dose of opiates and fixation of the head with a brace. Mean duration of the operative procedure was 51 minutes. Histologic analysis revealed a diagnosis of cancer metastasis in all cases. On average, 1.9 mL cement was placed within the vertebral body, and no cement leakage was observed in postoperative computed tomography and X-ray controls. All patients experienced immediate pain relief at Day 1 after the procedure (mean VAS 4.0, range 2–6), and a further decrease of pain levels was observed at Week 6 after the completion of radiation therapy (mean VAS 2.0, range 0–5).

CONCLUSIONS: In cases of metastatic C2 destruction, tumor excavation via an anterolateral approach and subsequent filling of the resection cavity with bone cement offers a safe and effective alternative to percutaneous approaches. © 2014 Elsevier Inc. All rights reserved.

Keywords: Axis; C2; Pain; Osteolysis; Metastasis; Tumor resection; Vertebroplasty

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Introduction

Because of the advancements in cancer treatment resulting in longer survival, the incidence and the need for treatment of spinal metastases is increasing [1]. The osteolytic tumorous destruction of the vertebrae usually leads to severe local pain, increasing instability and ultimately the collapse of the vertebral body with subsequent compression of the adjacent neural tissues. The percutaneous injection of polymethylmethacrylate (PMMA) into a clinically symptomatic vertebral body via vertebroplasty (VP) or kyphoplasty has been shown to be highly effective for both pain control and preservation of vertebral stability to maintain patient life quality and neurologic function [2–6]. Overall, there is only a low risk of treatment-related neurologic deterioration, but when complications occur, the sequelae are usually severe and permanent [7].

Metastatic involvement of the upper cervical spine and especially of the second cervical vertebra (C2) is an overall rare but a very challenging entity. The osteolytic tumor growth usually induces disabling neck pain, and a vertebral fracture can lead to direct upper spinal cord compression with a fatal outcome. Only patients in good general health with a solitary metastasis and a curative oncologic concept are suitable for an extensive surgical approach, such as a C2 spondylectomy [8]. Because most of the patients with metastatic lesions of the C2 harbor a limited prognosis because of systemic disease, a palliative concept with short hospital stay is required to maintain a good quality of life. The treatment should provide pain control and spinal stability to avoid the permanent wearing of a stiff cervical collar or a halo vest [9]. Regarding pain control and vertebral stability, conventional VP treatment of C2 lesions has proven to be as effective as in the thoracic or lumbar spine [10,11].

During the pressure-directed injection procedure, there is a potential risk of leakage of the liquid cement out of the vertebral body resulting in a severe or even fatal outcome; local complications because of cement escape into the spinal canal, with compression of the upper cervical cord and also distant complications from cement leakage into the surrounding vessels with subsequent embolization are described in the literature.

We present a series of seven patients suffering from severe neck pain because of the tumorous destruction of the C2 vertebral body. Because of osteolytic defects of the cortical boundary of their C2, they were considered to be high risk for cement leakage during a normal percutaneous pressure-directed VP treatment. Alternatively, a potentially safer strategy with open intravertebral tumor decompression and subsequent low-pressure filling of the resection cavity with PMMA was performed. The strategy of the surgical procedure and the patients' clinical and radiologic outcomes are presented in the following section.

Materials and methods

From July 2008 to July 2013, seven patients (five men and two women; mean age 70 years, range 50–83 years) were referred to our institution suffering from severe and increasing neck pain with or without radiation to the occiput because of the osteolytic tumorous destruction of the C2. None of the patients presented with a neurologic deficit. Malignant metastatic disease had already been diagnosed in five patients (kidney [two patients], prostate [two patients], and breast cancers [one patient]), whereas in two patients there was no history of cancer and the C2 metastasis was the first manifestation of a formerly unknown cancer (cancer of unknown primary [CUP] syndrome). Medical treatment, including the use of opiates and wearing of a cervical brace, was not able to control the patients' pain sufficiently. According to the visual analog scale (VAS), neck pain was estimated at VAS 8.1 (range 6–9) before treatment.

Imaging studies with X-ray, computed tomography (CT) with two-dimensional reconstruction, and magnetic resonance imaging with contrast medium application were performed in all cases to reveal the amount of bony destruction of the C2 and visualize the extent of tumor infiltration into the spinal canal and the surrounding soft tissues. There was no compression of the upper spinal cord or the adjacent neuroforamina, and also no C2 fracture with subsequent kyphosis at the upper cervical spine in any patient. Computed tomography revealed large bony defects of the C2 vertebrae with destruction of the cortical boundary dorsally (Fig. 1, A) or laterally (Fig. 1, B), with free "access" to the spinal canal or the C2 neuroforamina.

The primary treatment goals in this situation were clear histologic diagnosis of the pathology (especially in the two CUP patients), stabilization of the C2 and prevention of an impending fracture, and effective pain control. The possible treatment options (C2 vertebrectomy, biopsy and posterior C1–C2 fixation, biopsy followed by VP or kyphoplasty, and biopsy and halo vest treatment) were discussed with the patients. Because of age, comorbidities, metastatic status, and the potential hazards, all patients refused aggressive surgical treatment and thus, a palliative concept including VP with subsequent local radiation was offered to the patients. Because of the large bony defects of the C2 with the high associated risk of cement leakage during the normal percutaneous pressure-directed procedure, we developed an alternative approach including open resection of tumor tissue from the vertebral body and low-pressure cement filling of the resection cavity. All patients gave signed informed consent after being fully informed about the procedure and the potential treatment-related complications. The patients' demographic data are summarized in Table.

Procedure

The open treatment was performed in the operating room with biplanar X-ray control (two C-arm systems;

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