Iranian Journal of NEUROSURGERY

January 2020, Vol 6, Issue 1, No 20

Case Report:
Can C2 Vertebroplasty Restore Alignment in Pathologic Odontoid Fracture?

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Citation: Tarokh A, Safaei J. Can C2 Vertebroplasty Restore Alignment in Pathologic Odontoid Fracture. Iran J Neurosurg. 2020; 6(1):35-40. http://dx.doi.org/10.32598/irjns.6.1.6

doi: http://dx.doi.org/10.32598/irjns.6.1.6

Article info:
Received: 13 Jul 2019
Accepted: 03 Nov 2019
Available Online: 01 Jan 2020

Keywords:
Vertebroplasty, Solitary plasmacytoma, Pain

ABSTRACT

Background and Importance: Plasmacytoma is more likely to involve the spine with up to 50%, most commonly in the thoracic spine.

Case Presentation: This study examined a patient with solitary plasmacytoma with neck pain and abnormal C1-C2 range of motion, which happened to have an osteolytic C2 lesion on CT scanning. The patient underwent a fluoroscopically guided anterior percutaneous C2 vertebroplasty without posterior fusion, leading to management of pain, maintenance of normal motions, and restoration of cervical alignment.

Conclusion: This case represents fluoroscopically guided anterior percutaneous C2 vertebroplasty as an effective treatment for C2 osteolytic lesions with an abnormal range of motion, which can be considered in selected cases as an alternative approach for demanding open surgical approaches to this challenging region.

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Highlights

- Vertebroplasty plays a role in controlling pain, restoring the vertebral alignment, and treatment of focal pathologic lesion by vertebroplasty.

- Fluoroscopically guided anterior percutaneous C2 vertebroplasty is an effective treatment for C2 osteolytic lesions with abnormal range of motion.

Plain Language Summary

Percutaneous cement injection to the vertebra called vertebroplasty is a method of choice for treatment of some pathologic fractures that cause pain relief and may restore the height of vertebral body and alignment. In this study, percutaneous vertebroplasty was applied to treat C2 pathologic fracture which was determined as a solitary plasmacytoma. The results in patients' follow-up showed acceptable pain relief and restoring upper cervical vertebral alignment.

1. Introduction

Solitary bone plasmacytoma is a rare tumor of plasma cells which afflicts the axial skeleton and progresses indolently, resulting in pathologic fracture, deformity, instability, neurologic deficit, and pain [1]. Plasmacytoma is more likely to involve the spine (up to 50% of cases) and is most commonly found within the thoracic spine. Up to half of the patients diagnosed with plasmacytoma progress to develop multiple myeloma within 2 years. The diagnosis of solitary plasmacytoma is established histologically by needle or open bone marrow biopsy. Because plasmacytoma is a radiosensitive lesion, the conventional external beam radiotherapy is the primary treatment modality [1]. Surgical intervention is reserved for acute instability and neurologic compromise [1]. The patient had local and constant pain which worsened by active neck motion. The pain control consisted of different medications, hormone replacement, oral non-steroidal anti-inflammatory drugs, and osteogenic agents such as bisphosphonates [2].

Galibert and colleagues (1984) described percutaneous vertebroplasty as a treatment for vertebral hemangioma. Now vertebroplasty is approved as a standard remedy for other pathologies such as osteoporotic fractures and vertebral metastases [3]. Early and pain relief up to 90%, is the important benefit of this procedure. The complication rates were reported at 2%-4% [2].

In the lower and midcervical part of vertebral column, vertebroplasty performed with the anterolateral approach. By inserting the needle between carotid-jugular vessels laterally and the upper airways medially [2]. There were 2 methods for C2 percutaneous vertebroplasty [4, 5] direct trans-oral and transpedicular routes [3]. Post-operative infection, excessive bleeding and retropharyngeal abscess formation may occur in trans-oral vertebroplasty, which is less common in anterior

Figure 1. Pre-operative Extension

A: Pre-operative flexion; B: C2 instability

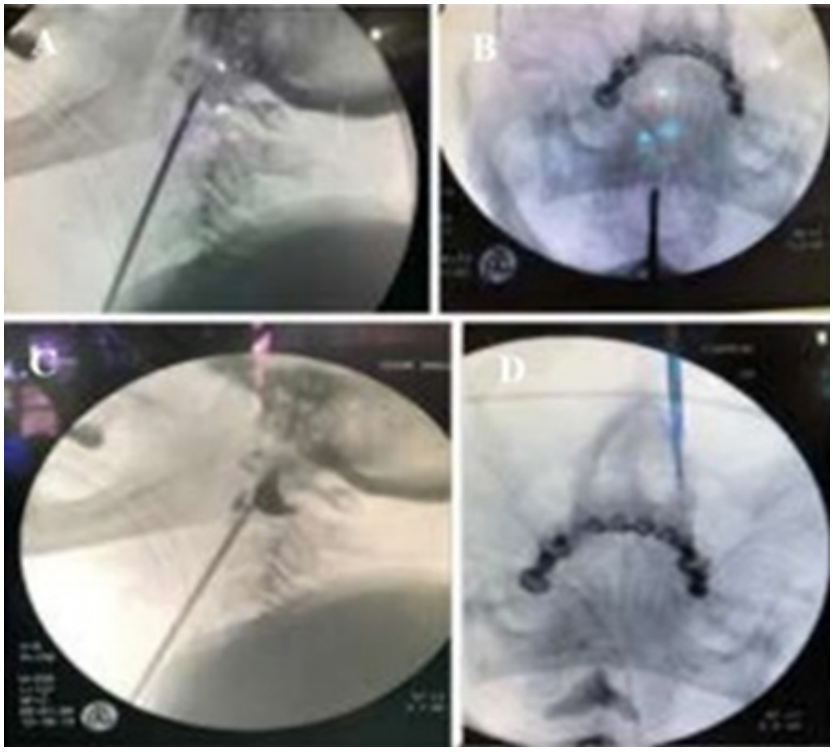

Figure 2. Intra-operative photograph of the surgical site

A, B: The image of fluoroscopic guidance toward C2; and C, D: The fluoroscopic image showing the filling of the lesion cavity with PMMA without any leakage

percutaneous approach [3]. Furthermore, pain relief via the exothermic reaction at bone Polymethyl Methacrylate (PMMA) [6] interface through destroying sensitized nociceptor endings, PMMA has shown to possess oncolytic [7] properties. This study reports a case of solitary plasmacytoma with osteolytic C2 lesion, for whom fluoroscopically guided anterior percutaneous C2 vertebroplasty was performed and C1-C2 alignment was restored through it. Thus long-standing control of pain and maintenance of normal motions without posterior fusion was another result.

2. Case Presentation

A 52-year-old female patient with severe axial neck pain over 5 months was admitted to NuroSpine Clinic,

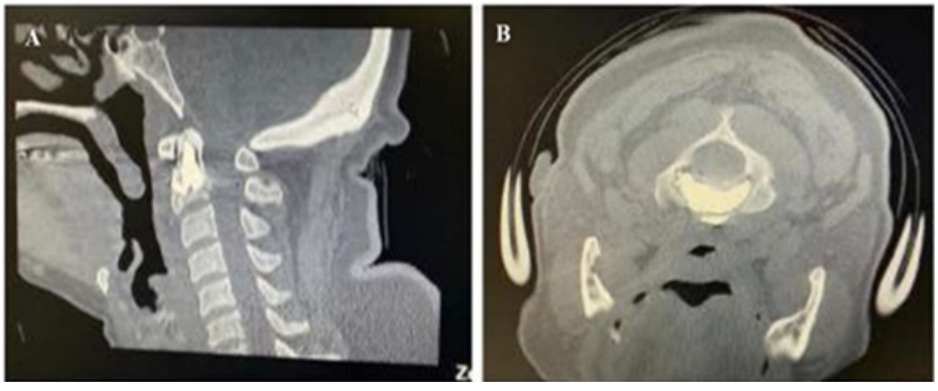

Figure 3. Post-operative sagittal and axial reconstruction of cervical CT scan showing the filling of the osteolytic defect of C2 with PMMA (A) axial

Figure 4. Cervical X-ray at the month 3 follow-up

A, B: Neutral; C: Extension; and D: Flexion; showing preserved alignment of the upper cervical spine

Shiraz. In physical examination, there was no neurologic deficits and severe tenderness was detected in upper cervical part. The pain was aggravated by cervical movement, especially in anterior flexion. Osteolytic lesion in C2 body with extension into the odontoid process was showed in cervical CT scan. The patient and her family gave written informed consent after being informed about the risks of the operation. She was admitted with impression of an osteolytic lesion in C2 and pathologic fracture. Primary lab data, such as hematologic profile and urine analysis was requested and metastasis work-up was performed in hospital course, all of which were negative and unsussecful in determining primary tumor or metastasis. Before operation, the Visual Analog Scale (VAS) score was 10. Her pain did not subside with pain reliever agents (Figure 1).

She was positioned supine. Her neck was extended, and a roll was placed under her shoulder between the scapulae after general anesthesia and intubation. The right aspect of anterior cervical was prepped. A 22-gauge needle was inserted percutaneous from anterior-inferior aspect into the C2 body under biplanar fluoroscopic guidance, and then replaced by a 13-gauge Jamshidi needle. After needle biopsy, about 3 cc of PMMA was injected to fill the lesion with continuous fluoroscopic guidance assisted and within 5 minutes the needle was gently removed. Fluoroscopic images dem-

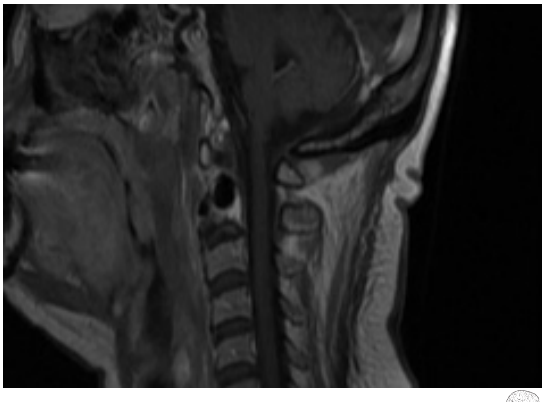

Figure 5. Post-operative MRI

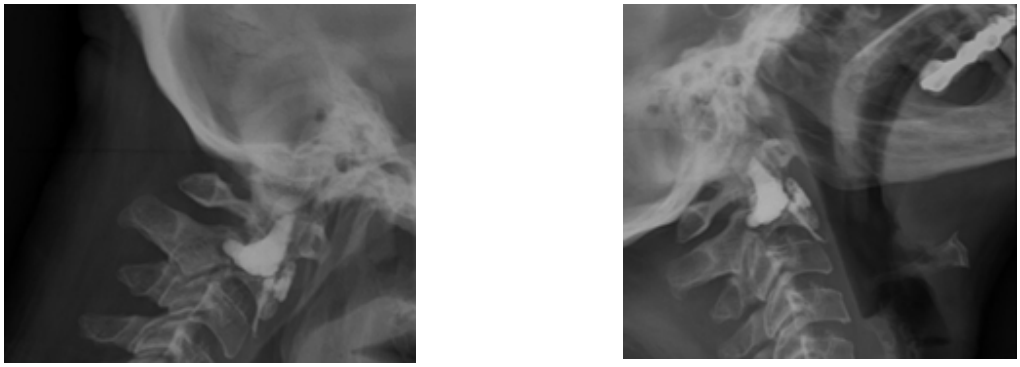

Figure 6. Cervical X-ray at the month 36 follow-up showing preserved alignment of the upper cervical spine

onstrated that the defect was completely filled without cement leakage from any aspects. A rigid cervical collar was used to immobilize the neck post-operatively. Immediately after recovery from general anesthesia, the VAS score decreased from 10 to 2. Early post-operative flexion and extension cervical X-rays showed acceptable C1-C2 alignment. The pathologic study of the samples revealed C2 solitary plasmacytoma. There was no other bony lesion confirmed via PET scan (Figure 2).

3. Discussion

Solitary plasmacytoma occasionally present with pathologic fractures, pain and neurological deficits secondary to canal compromise. Painful solitary plasmacytoma in any part of the vertebral column can be treated effectively by vertebroplasty [2]. PMMA injection not only can improve the cervical spine biomechanics by augmenting stiffness but also has pain relief effect due to having oncolytic properties and axial load-bearing capacity.

There are two approaches in the upper cervical spine; anterolateral and transpedicular. The potential complications of carotid-jugular and vertebral arteries injuries are usually reported in both procedures. Fluoroscopically guided anterior percutaneous C2 vertebroplasty can be safely performed as an acceptable approach to restore alignment and relive pain. This needs to be confirmed through further studies and meticulous investigations. Not many similar cases of this procedure are presented previously. Farrokhi et al. [2] reported transoral vertebroplasty in patients with C2 metastasis for pain palliation. According to their report, this technique led to a significant rise in VAS. They proposed that vertebroplasty (VAS=0) could relieve pain in patients with metastasis from breast cancer (Figure 3-5).

In some studies [8, 9] the transoral vertebroplasty of C2 metastatic lesion with posterior fusion was reported. It seems that, in the absence of instability, we may refuse to perform posterior fusion. Vertebroplasty reduces pain and improves the C2 biomechanical characteristics [9]. Nonetheless, posterior fusion restricts movement and can finally reduce the patient's quality of life.

This finding presented with anterior percutaneous vertebroplasty of a C2 pathologic fracture, to achieve acceptable biomechanics and maintain normal cervical motion, without posterior fusion procedure, and pain palliation after 36 months of follow-up. It is believed that this approach has a high potential risk of bleeding and vascular injury, as of other minimally-invasive procedures. Adequate experience, meticulous technique, and accurate case selection, are essential to perform this procedure successfully.

4. Conclusions

Percutaneous C2 vertebroplasty may be recommended as an acceptable treatment for C2 pathologic fracture. The results, according to the follow-up period, include pain palliation, normal cervical motion and higher quality of life. We believe that this procedure needs more evaluation, and the safety, pain relief, maintenance of motion and correction of instability in such pathologies should be assessed (Figure 6).

Ethical Considerations

Compliance with ethical guidelines

All ethical principles are considered in this article. The participant was informed about the purpose of the research and its implementation stages; she was also assured about the confidentiality of their information; moreover, she was free to leave the study whenever she wished, and if desired, the research results would be available to her.

Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

Authors' contributions

Conceptualization, data analysis, supervision: Majid Reza Farrokhi, Amir Tarokh; Data collection: Amir Tarokh; Drafting the article: Amir Tarokh; Critically revising: Majid Reza Farrokhi, Amir Tarokh, Javad Safaei; Reviewing submitted version of manuscript: Amir Tarokh, Javad Safaei.

Conflict of interest

The authors declared no conflict of interest.

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