

# Percutaneous Screw Fixation and Cementoplasty to Stabilize Unstable Osteolytic Fracture of Odontoid Process

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## Research Article

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# Abstract

**Introduction:** We relay a case of unstable lytic secondary fracture of odontoid process (C2) treated by screw fixation and cementoplasty, using a percutaneous approach.

**Case Presentation:** A 62-year-old female patient followed for a breast neoplasia with bone concurrent metastases, suffered from diffuse cervical pain. A CT-scan showed a lytic fracture of C2. The procedure was performed using CT-scan guidance under general anesthesia. After a biphasic enhanced CT scan of the neck and cervical spine, a needle was slowly inserted to hydrodissect the jugulocarotid and prevertebral spaces up to the anterior cortex of C2 using an iodinated contrast agent solution diluted 5% with saline water. Under fluoroscopy guidance and intermittent CT monitoring, a bone pin was navigated through the anterior cortex of C2, and then advanced inside the vertebral body of C2. After checking for optimal positioning of the bone pin, a 34mm-long titanium screw was inserted into C2 until reaching the posterior cortex. The approach to the transverse fracture line of the body of the odontoid was tangential with no displacement of the bony parts. Cement injection was then performed. One month after the procedure, a CT scan showed no material displacement, and the patient had no visible skin scarring. The patient regained full mobility of the cervical spine, and the pain decreased from 7/10 before the procedure to 0/10 after the procedure according to the patient.

**Conclusion:** Percutaneous screw fixation and cementoplasty to stabilize unstable osteolytic fracture of odontoid process is safe and feasible

## Introduction

The occurrence of bone metastasis has a major impact on the prognostic course of cancer, especially in cases of pathologic fracture. Improvement of cancer treatments and longer life expectancy lead to an increase in the incidence of older patients with metastatic bone disease. Bone metastasis related diseases are associated with pain, loss of mobility, reduced quality of life, morbidity and mortality. Cervical spine metastases may be responsible for pathologic fractures with the underlying risk of spinal cord compression. Open surgical approaches remain the reference treatment for pathologic fractures of C2 (second cervical vertebra) but may be suboptimal to treat patients with bone metastatic disease and comorbidities. Percutaneous approaches are a minimally invasive alternative to treat these fractures. Hydrodissection reduces blood loss and risk of infection. It also allows for significant reduction of pain, fast recovery and continuity of systemic treatment. The physical and chemical properties of polymethyl methacrylate (PMMA) cement provide resistance to compressive forces experienced during weight-bearing activities, and the screw allows resistance to flexural, torsional and tensile forces. This combination of PMMA cement and screw fixation is increasingly used for pelvic girdle injuries [1,2], but other locations may also benefit from this approach [3–4].

## Case Report

We here relay a case of unstable lytic secondary fracture of odontoid process (C2) treated by screw fixation and cementoplasty, using a percutaneous approach. A 62-year-old female patient followed for a breast neoplasia diagnosed eight years prior, with liver, lung and bone concurrent metastases, suffered from diffuse cervical pain. A CT-scan showed a lytic fracture of C2 (Fig. 1A). After a multidisciplinary team meeting between oncologists, surgeons, interventional radiologists, pain physicians and radiation oncologists, we decided to treat the unstable C2 lesion percutaneously. The patient was fully informed by the interventional radiologist during a preoperative consultation. The Ethic committee of \*\*\* approves the study (IRB\*\*\*). The procedure was performed using CT-scan guidance (CONFIDENCE 20, Siemens Healthineers, Princeton, NJ, USA), under general anesthesia. The patient was placed supine with the neck in neutral position and the head slightly turned to the left using a chin strap. After a biphasic enhanced CT scan of the neck and cervical spine, a 22-Gauge 88mm needle (BD Microlance Becton Dickinson SA, Madrid, Spain) was slowly inserted to hydrodissect the jugulocarotid and prevertebral spaces up to the anterior cortex of C2 using an iodinated contrast agent solution (IOPAMERON 200, Guerbet, France) diluted 5% with saline water (50mL) (Fig. 1B). Under fluoroscopy guidance and intermittent CT monitoring, a 1.4\*150 mm bone pin (Stryker, Kalamazoo, MI, USA) was navigated through the anterior cortex of C2, and then advanced inside the vertebral body of C2. After checking for optimal positioning of the bone pin, a 34mm-long titanium screw with 18mm partial thread ASNIS 3 (Stryker, Kalamazoo, MI, USA) was inserted into C2 until reaching the posterior cortex. The approach to the transverse fracture line of the body of the odontoid was tangential with no displacement of the bony parts. Cement injection was then performed with a 18G bone trocar and injection of 2mL of PMMA cement PALACOS® R + G (Heraeus Medical GmbH, Wehrheim, Germany) using the same bottom-up approach. The final CT scan confirmed satisfactory positioning of the screw and cement. (Fig. 1C,1D). A single superficial skin suture was made. The patient was kept in hospital for observation and discharged without any complications one day after the procedure. The patient additionally underwent a chemotherapy session the morning after the procedure. One month after the procedure, a CT scan showed no material displacement, and the patient had no visible skin scarring. The patient regained full mobility of the cervical spine, and the pain decreased from 7/10 before the procedure to 0/10 after the procedure according to the patient.

## Discussion

This case and our description support and add to the literature on the feasibility and the safety profile of screw fixation of odontoid process using a minimally invasive approach. Further procedures will improve the technique in this complex anatomical region.

## Declarations

### i. Funding:

No funding

## **ii. Conflicts of interest/Competing interests :**

No

## **iii. Ethics approval :**

The Ethic committee of \*\*\* approves the study (IRB\*\*\*)

## **iv. Consent to participate:**

Yes

## **v. Consent for publication (include appropriate statements):**

Yes

## **vi. Availability of data and material (data transparency) :**

Yes

## **vii. Code availability (software application or custom code):**

Not applicable

## **viii. Authors' contributions :**

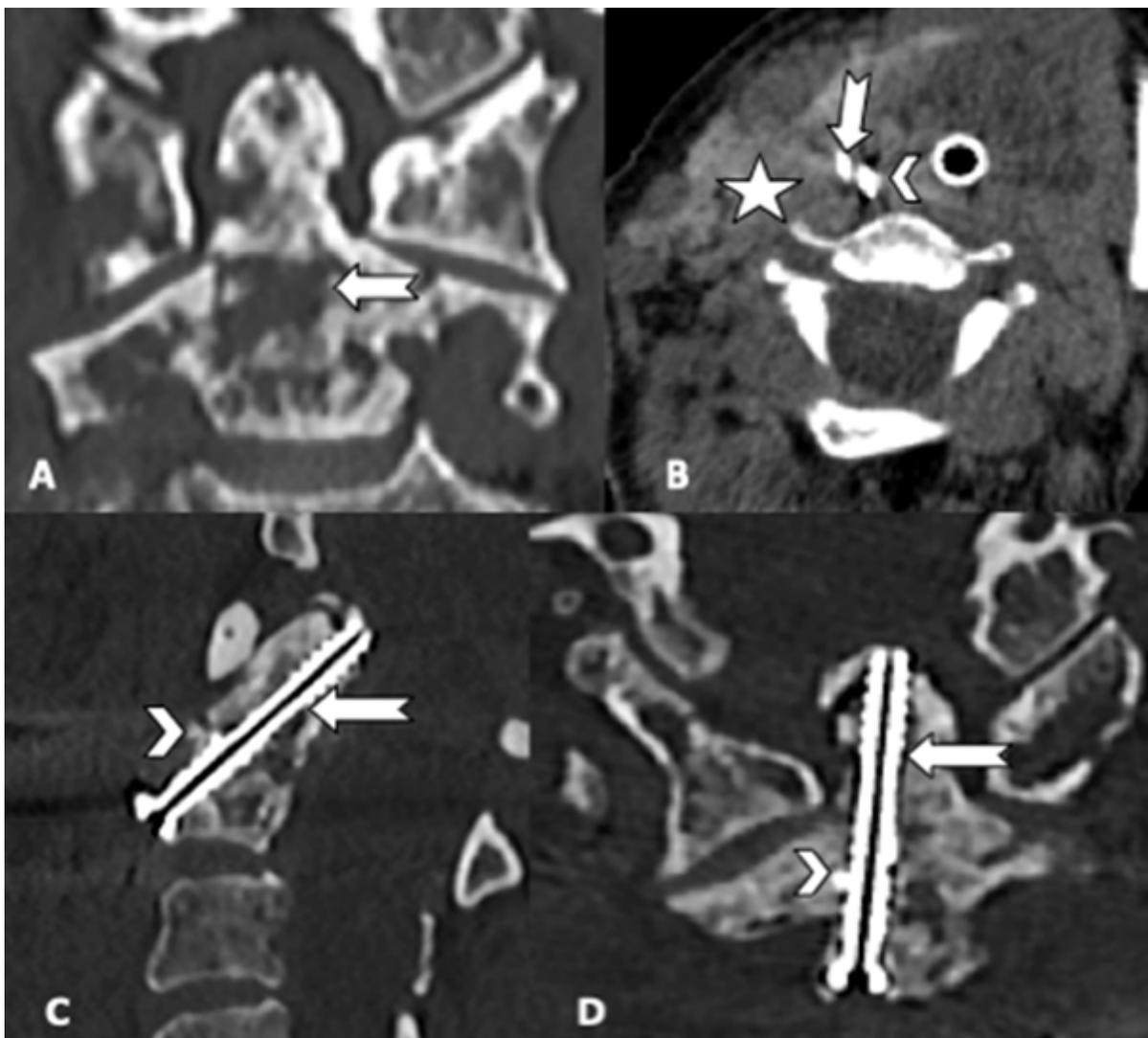
S.Grange, R.Grange, M-C.Tetard, L.Grange et S.Bertholon performed the operating procedure. C.Vassal and S.Morisson took care of oncology and pain management. L.Grange and S.Grange draft the manuscript. All authors have corrected and approved the manuscript.

## **References**

1. Garnon J, Meylheuc L, Cazzato RL, Dalili D, Koch G, Auloge P, et al. Percutaneous extra-spinal cementoplasty in patients with cancer: A systematic review of procedural details and clinical outcomes. *Diagn Interv Imaging*. déc 2019;100(12):743-52.

2. Deschamps F, Yevich S, Gravel G, Roux C, Hakime A, de Baère T, et al. Percutaneous Fixation by Internal Cemented Screw for the Treatment of Unstable Osseous Disease in Cancer Patients. *Semin Interv Radiol.* oct 2018;35(4):238-47.
3. Voelker A, von der Hoeh NH, Heyde C-E. Balloon kyphoplasty and additional anterior odontoid screw fixation for treatment of unstable osteolytic lesions of the vertebral body C2: a case series. *BMC Musculoskelet Disord.* 27 juill 2018;19(1):259.
4. Cianfoni A, Distefano D, Isalberti M, Reinert M, Scarone P, Kuhlen D, et al. Stent-screw-assisted internal fixation: the SAIF technique to augment severe osteoporotic and neoplastic vertebral body fractures. *J Neurointerventional Surg.* juin 2019;11(6):603-9.

## Figures



**Figure 1**

62-year-old woman with bone metastasis disease related to breast cancer, including the vertebral body of odontoid process. This figure shows the different steps of the intervention that included step

hydrodissection, bone access, screwing and cementoplasty. A. Preoperative CT-scan images in coronal section showing a large osteolytic lesion of the vertebral body of C2 extended to the odontoid process (arrow) which presents a transverse fracture. B. Axial CT-scan images showing an anterolateral approach to C2 with the advance of the bone pin (arrow) facilitated by the hydrodissection of the the cellulo-fat (star) and jugulo-carotid vascular spaces with the use of a 22G needle (arrowhead). C,D. Postoperative sagittal and coronal and CT-scan sections showing a satisfactory position of the screw until cortical (arrow) and cement along the screw (arrowhead).