

Endoscopic Transnasal Management of an Irreducible Odontoid Fracture with Occipito-C2 Fixation: A Case Report

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Abstract

Odontoid fractures are potentially serious injuries due to their proximity to the medulla oblongata of the brainstem. Their management can be medical or surgical, depending on their stability or instability. Irreducible cases are difficult to treat. The objective is to show the course of a case managed by nasal endoscopy and occipito-C2 fixation. This involves a 22-year-old patient who fell from a tree, resulting in a type II Anderson and D'Alonzo fracture that became irreducible due to the family's refusal of surgery and later led to deficits. He underwent nasal endoscopic odontoidectomy followed by occipito-C2 fixation without the use of brainstem evoked potentials, with good progress.

Keywords

Fracture, Odontoidectomy, Endoscopy, Instability, Nasal

1. Introduction

Odontoid fractures account for 5% - 15% of spinal fractures and are more common in the elderly [1] [2]. They are potentially serious injuries due to their proximity to the medulla oblongata of the brainstem. These fractures were classified by Anderson and D'Alonzo into three types, with surgical treatment recommended for type II [3]. Surgical treatment options include anterior odontoid screw fixation described by Bohler [4], used in younger patients; anterior transarticular C1-C2 stabilization, mainly in elderly patients [5]; posterior transarticular C1C2 stabili-

zation [6] described by Jeanneret and Magerl; the Harms/Goel technique modified by Harms and Melcher [7]; and C0-C3/C4 fixation. The Harms technique is currently the most widely used, but it does not allow adequate reduction and spinal cord decompression in the case of old consolidated fractures. These so-called irreducible fractures are very difficult to treat; a trans-oral approach with posterior C1-C2 fixation has been performed by several authors [8], but it comes with patient constraints and complications such as dysphagia and velopharyngeal insufficiency [9] [10]. The endoscopic approach is increasingly used in the treatment of odontoid pathologies, particularly basilar invaginations, os odontoideum, carcinoma metastases, as well as odontoid fractures [11]. Endoscopic transnasal odontoidectomy appears to be a good therapeutic option to achieve 360° decompression in irreducible odontoid fractures.

The objective of this work was to clinically and radiologically evaluate the patient and to share our experience in the management of irreducible odontoid fracture using this approach.

2. Clinical Case

This is a 22-year-old patient with a personal medical history of relative health and a family history of hypertension, who suffered a fall from the height of a tree with craniospinal impact without initial loss of consciousness. The patient presented with posterior cervical pain without neurological deficit.

Ten days later, the patient presents with difficulty walking and lifting the upper limbs, associated with neck muscle stiffness, and consults at the hospital. Physical examination confirms tetraparesis with muscle strength rated at 4/5 without sensory disturbances. Cervical spine CT scan reveals a type II odontoid fracture according to the Anderson D'Alonzo classification (**Figure 1**). Surgery was proposed to the family, who refused this option. The patient was placed on analgesics, anti-inflammatory medication, and a rigid collar, and then discharged.

Reviewed at 3 months for neurological worsening, the patient was completely dependent on his family. The neurological examination revealed tetraplegia with muscle strength of 2/5 associated with hypoesthesia, without swallowing or respiratory disorders. A new cervical CT scan was requested, showing a consolidated fracture in kyphosis (**Figure 2**) with an associated C1-C2 rotation. An additional magnetic resonance imaging (MRI) scan was performed to assess the impact on the spinal cord (**Figure 3**). We proceeded with the placement of Gardner traction with an initial weight of 5 kg, gradually increased to 20 kg over 10 days, without significant reduction on subsequent scans.

The decision to perform a 360° decompression via a transoral approach was made because we already had experience with this approach. In view of the post-operative complications, we decided on an endonasal approach for removal of the anterior arch of C1 and excision of the odontoid fragment, combined with occipito-C2 fixation.

The patient underwent surgery in two stages under general anesthesia, first via

nasal endoscopy and then posteriorly with removal of the posterior arches of C1, followed by occipito-C2 fixation (**Figure 4**).

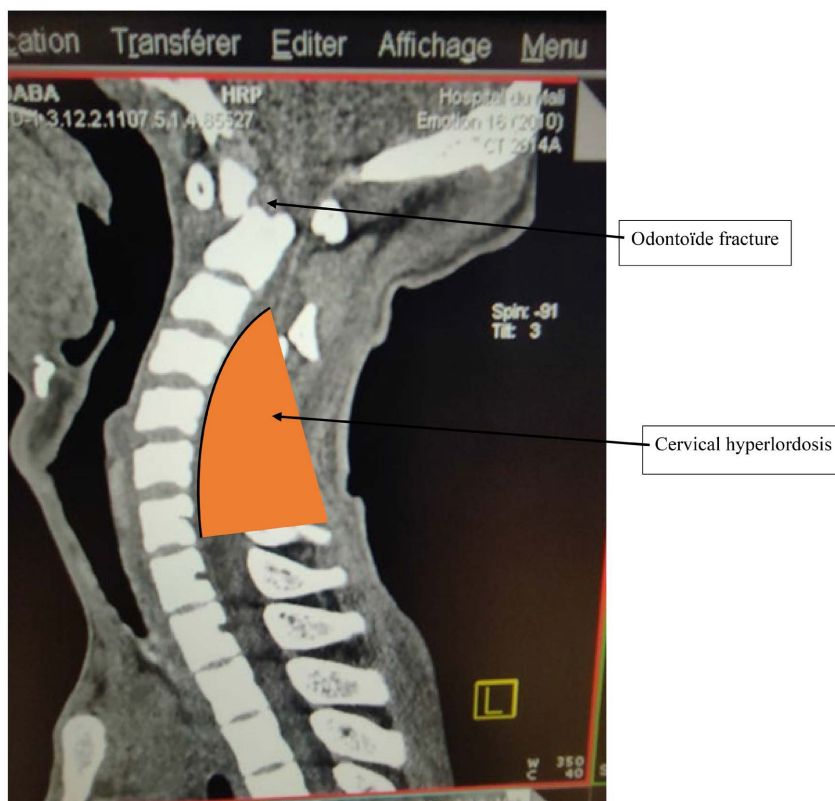


Figure 1. Cervical CT scan 10 days after the trauma showing a type fracture.

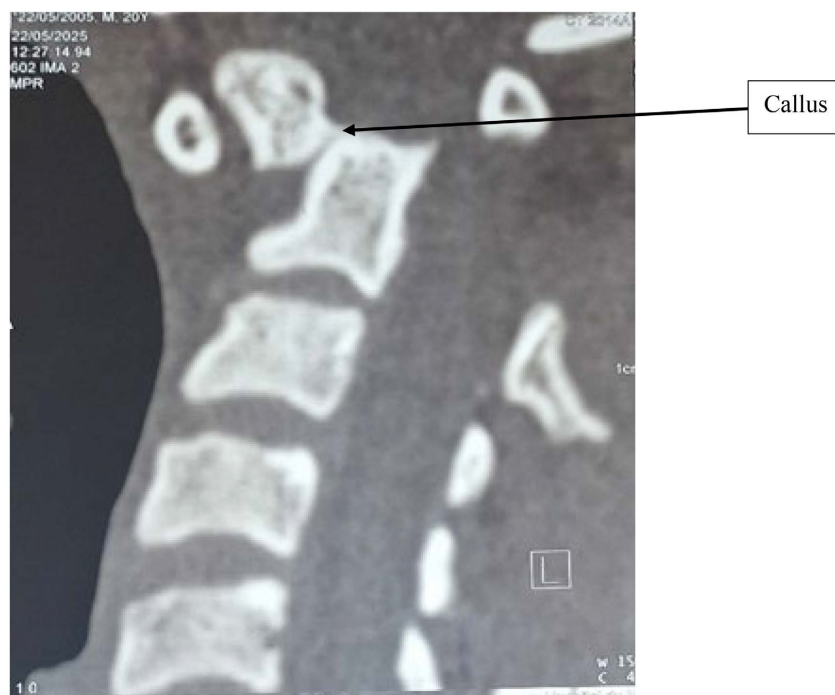


Figure 2. Healed fracture.

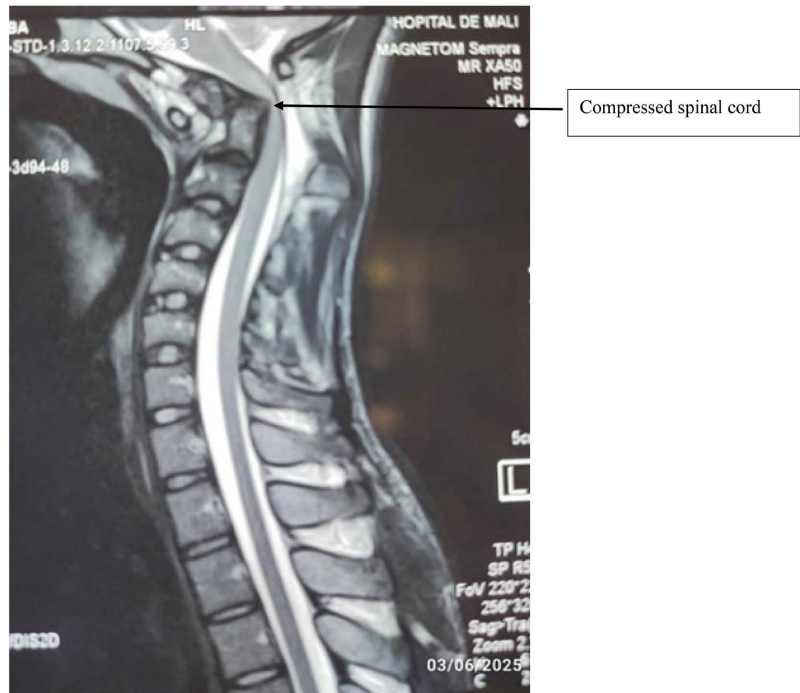


Figure 3. Cervical MRI at 3 months post-trauma, showing compression of the cervical spinal cord.



Figure 4. Postoperative control scan.

Pedicle screw fixation was chosen over facet screw fixation for its strength. During intraoperative fluoroscopy, we noted a deviation of the left screw; an attempt

to reposition it revealed that we were in the left vertebral artery, through the bleeding along the screw path. We proceeded with suction and packing. We then tried to stop the bleeding with Gelfoam and bone wax without really being able to stop it. Since the bleeding was under control before removing the screw, we replaced it and asked the anesthetist to keep the mean arterial pressure above 90 mmHg (**Figure 5**). The patient stayed in intensive care for 3 days with monitoring of consciousness, cardiovascular and respiratory functions, as well as surveillance of the surgical site drain. The post-operative Doppler ultrasound of the vertebral arteries showed that the right was dominant, but the left remained patent (**Figure 6**).

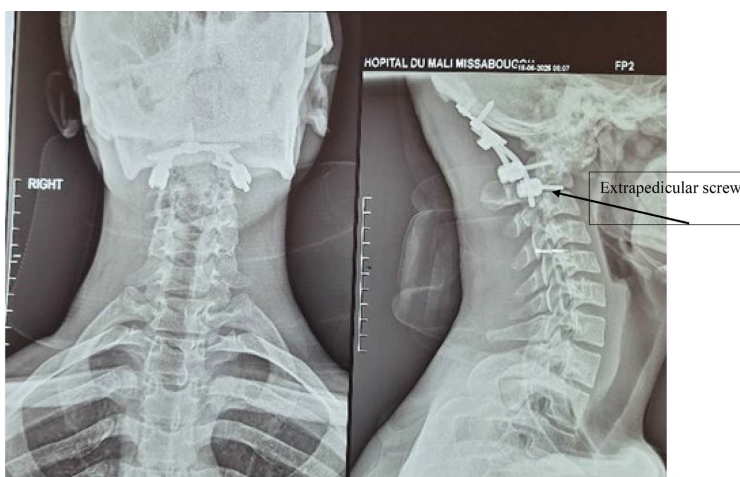


Figure 5. Postoperative control X-ray, frontal and lateral views.

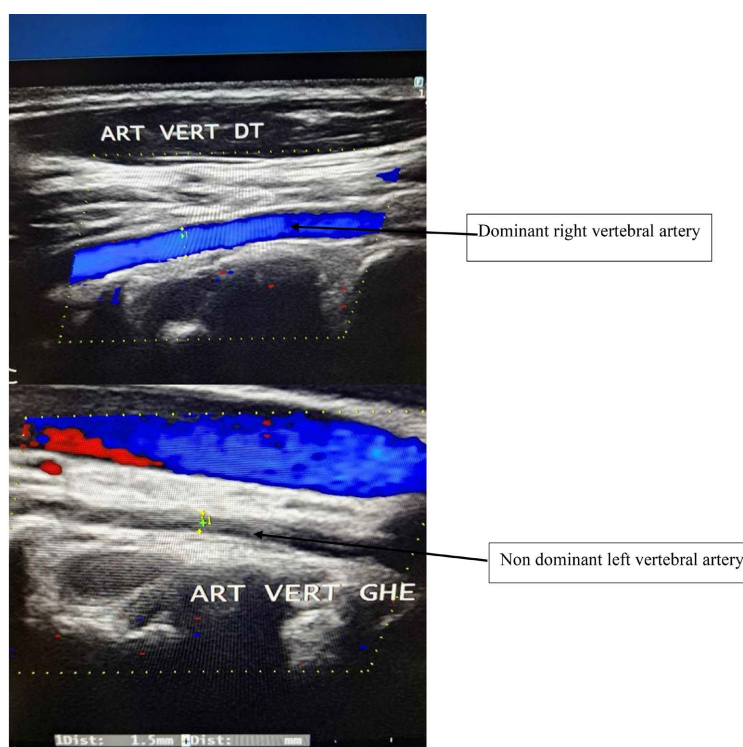


Figure 6. Post-operative Doppler ultrasound of the vertebral arteries.

The neurological outcome was favorable; the patient underwent motor rehabilitation of all four limbs combined with muscle electrostimulation. The complete recovery from the motor deficit with the MRC grading 5 at 2 months postoperatively and without a collar. The patient was allowed to resume studies 4 months after the surgery.

3. Discussion

Odontoid fractures are quite common, accounting for about 15% of vertebro-medullary traumas [12]. The incidence is not well known in Mali due to the absence of a national study, but in a single-center article, the authors collected 12 cases of isolated axis fracture, half of which were type II according to Anderson and D'Alonso, and one case was type I [8]. These lesions are potentially serious due to their proximity to the medulla oblongata, and the objectives of their management are spinal cord decompression and stabilization of the atlantoaxial complex.

Initially, the criteria for surgical indication were a fracture displacement >5 mm, an angulation >10°, and the presence of neurological deficits, but these criteria have been expanded to also consider potentially high morbidity, instability, and secondary displacement in patients treated conservatively [12] [13]. However, even surgery can result in nonunion rates of up to 33% [14]. In younger patients, the potential loss of C1/2 mobility must be taken into account. Therefore, direct anterior osteosynthesis or temporary posterior stabilization using the Harms technique are better options for this patient group [5]. The treatment of Anderson and D'Alonso type I fractures and nondisplaced type II fractures is orthopedic, with immobilization using a rigid collar for 6 to 8 weeks [5].

In type II fractures, once surgery is decided, the technique must be determined and planned. Reducible fractures are treated with anterior screw fixation, especially in young patients [8], and with posterior C1C2 screw fixation in elderly patients [15]. In irreducible cases, both anterior and posterior decompression are indicated along with posterior C1C2 fixation. After the fracture, the odontoid takes between a month and a half and two months to heal; in our case, there were 4 extra weeks, which contributed to the irreducibility. As a result, despite traction with a 20kg weight, we did not achieve a reduction of the fracture, which would have allowed us to either perform odontoid screw fixation or a posterior C1-C2 fixation without removing the anterior arch. After occipitocervical fusions (with the lower instrumented vertebrae being either at C2 or C3), Matsubayashi *et al.* [16] reported that there was an inverse correlation between the O-C2 angle, and the C2-7 angle after an OCF (O-C2 or O-C3) and our patient presented with O-C2 kyphosis, which would require significant C2-7 lordosis as a compensatory alignment change to maintain a horizontal gaze, which motivated the choice of fixation. We opted for 360° decompression with occipito-C2 fixation in order to immobilize fewer segments, taking into account the associated C1C2 rotation.

There are now improved transoral techniques [17] [18] whose implementation requires specific implants that are not available on our market.

Transnasal odontoidectomy is possible provided that appropriate endoscopic surgical instruments are available. The evoked potential of the brainstem is an advantage for the success of the procedure, which we do not have. Occipito-C2 stabilization has not been found in the literature we consulted; we chose it to reduce the number of immobilized segments given the young age of the patient.

4. Conclusion

Nasal approach odontoidectomy is an alternative to transoral odontoidectomy with fewer complications. The endoscopic endonasal corridor has been proposed as an alternative route that may decrease the incidence of postoperative velopalatal insufficiency and dysphagia and allow for earlier extubation and initiation of oral feeds compared to the transoral approach. It allows for complete decompression in irreducible odontoid fractures with good results.

Declaration of Patient Consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that her name and initials will not be published and due efforts will be made to conceal her identity, but anonymity cannot be guaranteed.

Conflicts of Interest

There are no conflicts of interest.

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