



## Original Article

# Anterior fixation of odontoid fractures: results<sup>☆</sup>

Q1 João Pedro Ferraz Montenegro Lobo\*, Vitorino Veludo Moutinho,  
António Francisco Martingo Serdoura, Carolina Fernandes Oliveira,  
André Rodrigues Pinho

Department of Orthopedics, São João Hospital, Porto, Portugal

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### ABSTRACT

**Objective:** To evaluate the clinical and radiological outcomes of the surgical treatment in patients diagnosed with odontoid fracture who underwent open reduction and internal fixation (ORIF) with screws.

**Methods:** This was a retrospective study with nine patients. Pain (visual analog scale [VAS]) and neurological status (Frankel scale) were assessed. The neck disability index (NDI) and the post-operative cervical range of motion were calculated. The cervical spine was radiologically evaluated (X-ray and CT) pre- and postoperatively.

**Results:** The mean age of patients was 70 years. All patients presented type IIb (Grauer classification) fractures, with a mean deviation of 2.95 mm. Two patients had subaxial lesions. The mean follow-up was 30 months. The mean time from trauma to surgery was seven days. The pre-operative Frankel score was E in all except one patient (B), in whom a post-operative improvement from B to D was observed. Post-operative pain was 2/10 (VAS). A total of 77% of patients presented a mild or moderate disability (NDI). Six patients regained full range of cervical movement, and bone union required approximately 14 weeks. Pseudarthrosis complications were observed in two patients (77% union rate), one patient presented screw repositioning and one case, dysphonia.

**Conclusion:** Delayed diagnosis is still an issue in the treatment of odontoid fractures, especially in elderly patients. Concomitant lesions, especially in younger patients, are not uncommon. The literature presents high fusion rates with ORIF ( $\geq 80\%$ ), which was also observed in the present study. However, surgical success depends on proper patient selection and strict knowledge of the technique. This pathology presents a reserved functional prognosis in the medium-term, especially in the elderly.

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<sup>☆</sup> Work performed in the Department of Orthopedics, São João Hospital, Porto, Portugal.

\* Corresponding author.

E-mail: [joao.2523@hotmail.com](mailto:joao.2523@hotmail.com) (J.P. Lobo).

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## Fixação anterior de fraturas do processo odontoide: resultados

### R E S U M O

#### Palavras chave:

Lesão cervical

Fratura espinhal

Fixação de fratura

Processo odontoide

Parafusos ósseos

**Objetivo:** Avaliar os resultados clínicos e radiológicos do tratamento cirúrgico em pacientes com diagnóstico de fratura do processo odontoide submetidos a redução aberta e fixação interna (RAFI) com parafusos.

**Métodos:** Esse foi um estudo retrospectivo com nove pacientes. Foram avaliados dor (escala visual analógica [EVA]) e do estado neurológico (escala de Frankel). O Neck Disability Index (NDI) e a amplitude de movimento cervical pós-operatória foram calculados. A coluna cervical foi avaliada radiologicamente (raio X e TC) nos períodos pré- e pós-operatório.

**Resultados:** A idade média dos pacientes foi de 70 anos. Todos os pacientes apresentaram fraturas do tipo IIb (classificação de Grauer), com desvio médio de 2,95 mm. Dois pacientes apresentaram lesões subaxiais. O seguimento médio foi de 30 meses. O tempo médio entre trauma e cirurgia foi de sete dias. O escore pré-operatório de Frankel foi E em todos exceto um paciente (B), em quem observou-se uma melhora pós-operatória de B para D. A dor pós-operatória de foi 2/10 (EVA). Um total de 77% dos pacientes apresentaram incapacidade leve ou moderada (NDI). Seis pacientes recuperaram toda a amplitude de movimentos cervicais; a união óssea levou aproximadamente 14 semanas. Foram observadas complicações de pseudartrose em dois pacientes (taxa de união: 77%), um paciente apresentou deslocamento do parafuso e um paciente, disfonia.

**Conclusão:** O diagnóstico tardio ainda é um problema no tratamento de fraturas odontoides, especialmente em pacientes idosos. As lesões concomitantes, especialmente em pacientes mais jovens, não são incomuns. A literatura apresenta altas taxas de fusão com RAFI ( $\geq 80\%$ ), o que também foi observado no presente estudo. No entanto, o sucesso cirúrgico depende da seleção adequada do paciente e do conhecimento rigoroso da técnica. Essa patologia apresenta um prognóstico funcional reservado no médio prazo, especialmente em idosos.

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## Introduction

Odontoid fractures comprise as many as 20% of all cervical fractures. The incidence of odontoid fractures increases substantially in older patients and represents the most common cervical fractures in patients older than 70 years.<sup>1</sup> These injuries usually result from low-energy impacts such as falls in the elderly or high-energy impacts such as motor vehicle accidents in the young and middle aged.<sup>2</sup> Type II fractures are the most common odontoid fracture, occurring in 65–74% of the cases. These fractures have similar biomechanical properties as transverse ligament injuries, i.e., a loss of the translational restriction of C1 on C2, creating the potential for spinal cord injury and severe late craniocervical deformities when healing is not obtained.<sup>3</sup>

Treatment strategies for odontoid fractures can vary from conservative management with an external immobilization (such as a cervical collar, Minerva, and other cervicorthotic orthoses, and halo orthosis), to operative management with anterior odontoid screw fixation (AOSF) or posterior cervical fusion with or without supplemental screw fixation.<sup>1</sup>

Anterior screw fixation of odontoid fractures was first described in 1980 by Nakanishi and again in 1982 in a report by Bohler based on an 8-year experience.<sup>4</sup> This procedure has the potential advantage of preserving cervical motion

and generally avoids the need for halo immobilization. It is technically challenging and has been associated with fracture pseudarthrosis rates of up to 20%.<sup>4</sup>

There has not been a clear consensus among trauma spine surgeons on the need for operation and the ideal timing of such fixation in patient with an odontoid fracture. Moreover, the choice of management (operative vs. non operative, halo-vest immobilization vs. cervical orthosis) has been postulated to influence mortality. The halo vest, in particular, has been associated with an increased risk of complications and death in elderly patients.<sup>5</sup>

The authors proposed to evaluate the clinical outcome, imaging and complications after surgical treatment of patients diagnosed with odontoid fracture undergoing reduction and anterior fixation with screws during the period of 1 January 2009 to 31 December 2014.

## Methods

### Patient population

Retrospective study, over a 6-year period (2009–2014) with 9 consecutive patients who underwent direct anterior screw fixation in the context of C1–C2 instability Anderson and D'Alonzo Type IIb odontoid fractures. There were 7 male and 2 female patients who ranged in age from 27 to 94 years.

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